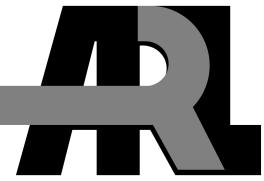ARMY RESEARCH LABORATORY

Lethality Server Performance Validation Analysis for the Virtual Proving Ground Distributed Test Event 4

by Geoffrey C. Sauerborn

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NOTICES

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14. ABSTRACT
The U.S. Army Research Laboratory's table look-up lethality server is a simulation support tool that resolves damage to vehicles or other entities, based on pre-calculated (look-up) vulnerability tables. The server provides those damage results in a timely manner, allowing simulated entities to represent those damage effects in an appropriate way (e.g., become mobility or fire power "killed"). This report presents results from the server's recent participation in the Distributed Test Event Four (DTE-4). DTE-4 was a demonstration of simultaneously executed distributed test support activities spread across the U.S. Army Test and Evaluation Command. The results are viewed in terms of observing the server's behavior from a verification and validation (V&V) perspective. This report presents the results (and detailed findings) from the V&V analysis. An added benefit from this report (and perhaps longer lasting value added) is that it documents server functional requirements (that apply to validation) and establishes recommended processes for executing V&V on the server. Combined, these form a general purpose lethality server V&V plan for future validation efforts as required.

15. SUBJECT TERMS
distributed simulation; lethality; simulation interface; vulnerability

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1. Background

With the advancement of computer and network capabilities, it became practical and efficient to segment simulated systems across various computer platforms. This advancement in distributed simulation also brought with it new dilemmas such as how to ensure a "fair fight". For example, when different simulations are brought together, each simulation may treat the data (vulnerability data, terrain, or other synthetic environment representations) with subtle differences that create an unfair advantage. Distributing applications also increases the risk of having incorrect or stale data configurations on one or more of the systems. The lethality/vulnerability server is a tool that was designed to overcome some of these obstacles and help ensure a valid weapon system assessment. It allows diverse applications to draw from the same vulnerability description data set during a simulation run. The server can increase simulation preparation efficiency because configuring vulnerability damage is done once for all serviced applications. It could also help streamline overall distributed simulation verification and validation because lethality data are in a single place.

2. Introduction

This report documents the performance for the U.S. Army Research Laboratory (ARL) table look-up lethality server (the server) during the U.S. Army Developmental Test Command's Virtual Proving Ground Program Distributed Test Event 4 (DTE-4).

The lethality server is designed to operate as a simulation support tool (see Bibliography). It monitors the virtual environment for munition detonations, calculates the resulting damage to vehicles or other entities, and provides that damage in a timely manner, thus allowing simulated entities to represent those damage effects in an appropriate way (e.g., become mobility or fire power "killed").

During DTE-4, the server executed all these tasks except for the very last step (it never provided the damage results). This provided the opportunity to evaluate the server's performance without disrupting the normal operation of the other simulated entities. These simulated entities were allowed to process damage as they normally would (through their own internal process). In parallel, the server calculated damage effects during the same conditions. This provided a basis to evaluate the server's performance and correctness.

In this report, the server's performance during DTE-4 (and intensive post-exercise re-runs) is analyzed in detail to validate and document the server's current operational state.

3. Report Organization

DTE-4 is introduced in section 4 but is not covered in detail since this is not the report's purpose.

The report introduces a plan to execute a functional analysis of the lethality server's performance in section 5. Procedures that were followed in the execution of this plan are outlined in section 5.2. Explanations of the data analyzed, along with general (and detailed) observations made during the evaluation, are presented in section 6. Finally, a listing of problems and resolutions is presented throughout the report's body but is consolidated in appendix A. Most of the validation procedures presented in section 5.2 could and should be followed as part of a pre-simulation checklist (but here they are being applied in a verification and validation process).

4. Distributed Test Event 4 (DTE-4)

4.1 DTE-4 Overview

In distributed testing, a component, system, or systems might be stimulated and tested from different geographical sites simultaneously or in short sequence. DTE-4 was a means to investigate and demonstrate enabling components, procedures, and activities central to distributed testing. During DTE-4, the U.S. Army Test and Evaluation Command simultaneously executed test support activities across its command. These activities included constructive, virtual, and live assets translated into a common virtual environment. For example, some of the live Army assets executed typical testing tasks (e.g., firing weapon systems, ground and air vehicles executing mobile navigation, test apparatus stimulating infrared optics, to name a few). These assets were operated by subject matter experts from their base stations, as portrayed in figure 1.

Among DTE-4 goals was to demonstrate the capability to support the execution of operational mission threads developed for Future Combat Systems to assess the network fires and force health protection integrated processes and to develop and support distributed testing lessons learned. A DTE-4 overview and preliminary overall results have been presented and are available elsewhere (*1*) as are details from other components and DTE-4 aspects (*2, 3, 4, 5, 6, 7*).

Figure 1. DTE-4 concept of operations (slide 4 of reference (*1*)).

4.2   Lethality Server DTE-4 Integration

The server has been integrated into various simulation environments. For DTE-4, the server's synthetic environment monitor (high level architecture [HLA] monitor of figure 2) was modified to support the simulation object model used in DTE-4. The server's monitor component is the server's internal working engine's interface to the outside world. The server has its own internally defined set of coordinate systems, variables, and protocols. These often differ from other simulation environments and object models. The monitor is the server's interface bridge into the synthetic environment and external simulation object model.
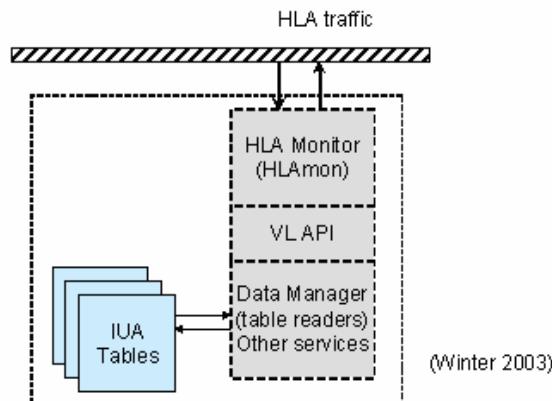
Figure 2. Basic lethality server design.

5. Lethality Server Analysis Approach

The plan to analyze the server's performance is defined first by a list of requirements and by an outline of a set of procedures that can be followed to test against those requirements.

5.1 Execution Requirements

Much of the server's behavior may be isolated in order to measure its response from stimulus and this may be evaluated independently in stand-alone mode.[1] Stand-alone analysis is not always sufficient for a simulation component that is an integral part of a distributed environment because its behavior often depends on the other components within that environment. The requirements listed in table 1 take into account dependent (simulation environment) and independent (stand-alone) responses, and they outline the plan to analyze the server's performance with the focus on its correct operation. At a minimum, the server should demonstrate that it is able to detect, process, and return the correct damage result for 100% of the munition detonations that occur. The server is only expected to process detonations for weapons for which it has vulnerability algorithms and data. This limits its activity to most direct fire munitions and eliminates indirect fire munitions (mortars, howitzers) and some other weapons since there was not sufficient time to complete implementation and testing of these components for DTE-4.

To verify the server's operation, we simply need to verify that it is properly handling incoming data (input) and processing them correctly to produce the correct damage results (output). We define the critical requirements in table 1.

Table 1. Requirements: Must demonstrate 100% success.

R-1. Input Correctness: (Was the input data available and was it correct?)
      R-1.1.) System identification (targets/threats, and to lesser extent shooter)
          Could the server identify the specific type of threat and target involved?
      R-1.2.) Input Completeness
          Given system identification, were other data present and complete?
      R-1.3.) Vulnerability data source completeness.
          Having properly identified target, threat, and other vital parameters, was there a vulnerability data source for that scenario?
 	
R-2. Output correctness: (To be checked after verifying availability of the target and threat and lookup table (the inputs).)
      R-2.1.) Was the data source processed (lookup table parsed) correctly?
      R-2.2.) What was the result delivered in a timely manner?

LV table look-up server critical requirements for which it has vulnerability algorithms and data.

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[1]Stand alone – independent evaluation of a component when it is not interacting with other components in the distributed setting. Much or all of a component's functionality may be tested in stand-alone mode by stimulating its interfaces with same data that are expected in the distributed environment.

Our measure of effectiveness (MOE) against these requirements (except for R-2.2) shall be "is the server successful 100% of the time?" Requirement R-2.2 (latency) is not applicable for two main reasons: (1) as mentioned in the introduction, the server did not actually send the lethality result and (2) for evaluation purposes, its speed performance was not optimized as it was required to produce verbose data files and other output to support verification and validation (V&V) (as discussed in section 6.1). One more stipulation to achieving the MOE with 100% success is that the server may be viewed as passing a failed requirement if it can be shown that a failure to achieve the MOE is attributable to another component (i.e., the server was doing all it was prescribed to be doing and therefore, the failure was no fault of the server). Of course, in such a case, all attempts shall be made to identify and document a solution.

We next outline a procedure to address these requirements. This procedure then basically becomes a V&V outline for the table look-up server. During our analysis, we took this process a step further because we were not just interested in identifying problems, but we also wished to identify and possibly implement solutions. Therefore, if a problem was identified, the solution was also sought (and applied). When a problem was identified, it was registered as a program trouble report (PTR) and the problem description (and solution if one was found) was documented.[2] We could verify implemented solutions by replaying the simulation traffic and confirming that the server's behavior had improved. This process is illustrated in figure 3 with the details, and the process is further articulated in section 5.2.
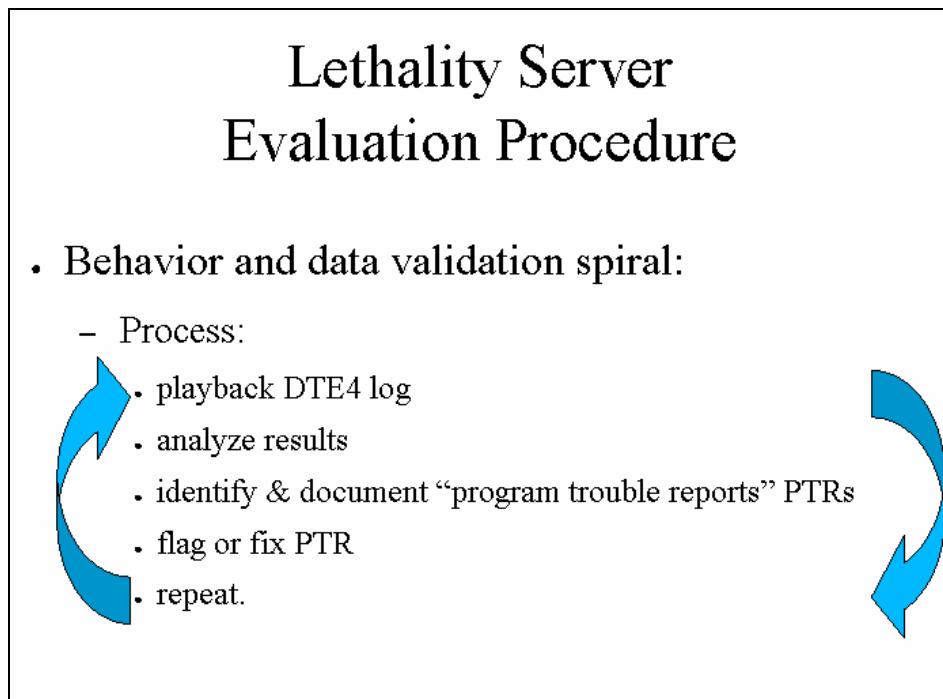
Figure 3. Lethality server analysis (sprial) process.

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[2]PTR is the problem tracking and resolution process adopted to manage server configuration at a business process and technology transfer level of understanding. It is also the means to maintain an institutional memory of outstanding issues requiring resolution.

5.2   Validation Procedures

This section outlines specific guidance that was followed during the server evaluation spirals. In general, this analysis was approached in the way simple math problems might be checked; namely, if you know the answer, then check the solution first. If the answer is wrong, then work backward to see where the error occurred. Likewise, this analysis started from the most critical requirement element: Was the server's lethality result (the server's output R-2 from table 1) correct? Then, if any erroneous behavior was observed, we worked "backward," eventually ending at the input and along the way determining the fundamental cause for the error (and hopefully repairing it). In all cases, any problems and solutions were documented and registered among the PTRs (see appendix A). We list the validation procedures in table 2.

Table 2. Validation procedures.

	Procedure
P1.	Create a listing of MunitionDetonation events for study
P2.	Analyze the MunitionDetonations
P3.	Address vulnerability data configuration issues (*data configuration*)
P4.	Address vulnerability assessment algorithm issues (*software*)

The procedures listed here could (and should) be followed as part of a pre-exercise checklist. Procedures P2 through P4 could be executed off line and before a scenario exercise. In contrast, P1 requires observations from an actual scenario execution or pre-test. These procedures are now explained.

P1. Create a listing of MunitionDetonation[3] events

For each recorded detonation, list the associated WeaponFire event, the threat, target, and shooter, if these are known. We may then categorize the server's response to each of these records according to our known critical requirements. This means that for each detonation, when the server was not able to properly determine all input required to determine the damage outcome, we should ascertain why. The exact data set comprising required input may vary, depending on the threat and target presented. The reason the server could not identify all required input would then be classified as a functional problem (requiring programming to avoid future occurrences), a configuration problem (requiring the addition or modification of data files), or a systemic problem applicable to multiple components in the distributed exercise (in which case, identify the cause and solution if one was found). Solutions are to be carefully noted and made available for future distributed tests.

P2. Analyze the MunitionDetonations

Verification should be made if possible by an examination of logs from other network locations (in the case of DTE-4, other test center distributed test control center [DTCC's]). The U.S.

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[3]MunitionDetonation – the HLA federation object model (FOM) data structure that contains detonation information needed to assess damage (see section 6.3 and figure 5).

Army Redstone Technical Test Center (RTTC) is preferred because most of the DTE-4 virtual entities originated from its DTCC. A comparison could then be made between the number of observed fires and detonations between RTTC and the lethality server. This will validate that the server is able to correctly observe the data items and that the data items navigated the wide area network (although overall distributed simulation validation is not this report's intent).

All unidentified entities need to be placed into the server's list of known system types: When the server is unaware of a target, threat, or firing weapon system type, this is a data configuration error because the server should be pre-configured to identify all entities in the scenario. Alternatively, it may be viewed as a scenario configuration control error, that is, if a rogue (unplanned) entity slipped into the simulation exercise.

Procedure: Identify any unknown systems in the scenario. Add these systems to the list of the server's known system types. Replay logs to verify that the server has knowledge of the added system types.

P3. Address vulnerability data configuration issues

Even though the target and munition are identified as "known systems," the server still may not have data to describe the resulting damage when that target is attacked by the threat. This is an error that needs correction.

All missing vulnerability tables will be noted. Data for these threat-target pairings will be added to the server's vulnerability database. Since DTE-4 was an unclassified exercise, these data may be taken directly from the unclassified oneSAF test bed (OTB) vulnerability data "tree" or other source. OTB is preferred because it was used to drive the DTE-4 scenario and the server is able to read its vehicle vulnerability file formats. When no existing data are available, surrogate data will be used for the threat-target pairing in question and the missing data will be noted in PTRs.[4]

P4. Address vulnerability assessment algorithm issues

Once the target and threat are known and data describing their interaction are confirmed to be available, the final check is to verify that the server is accessing and returning the correct damage result for that target-threat combination.

Use a matrix of observed weapon systems and target pairings that occurred during the battle (or are expected to occur when a pre-exercise check is executed). Examine at least one instance from each of these parings. Use the initial conditions described by the environmental parameters to manually (off line) verify that the server operated as expected (see appendix B). Verification means ensuring that the server used the correct table (accessed the correct data source) and then went to the correct place in that table to extract the damage distribution. These input parameters are reported by the appropriate MunitionDetonation and WeaponFire interactions and associated target and shooter entity state information. A summary of these parameters and the damage

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[4]See PTR number 24

results is reported in the VL_parameter record that is recorded for each detonation event. This same record is the server's internal view of what is happening in the external synthetic environment. The variables in this VL_parameter record are in a software/data dictionary layer (called VL Params in appendix C). Look-up table algorithms access the VL Param layer, execute the look-up on a given table, and return the lethality outcome. Since the server currently reads only six table formats (kinetic energy [KE], high explosive antitank [HEAT], and smart target activated fire and forget [STAFF[5]] individual unit action [IUA]) plus OTB "reader" (.rdr) format versions of these same table formats), it is relatively straightforward to execute a complete and exhaustive validation of the server's look-up functionality. The server has off-line tools that can stimulate table look-up algorithms to expedite this validation process.[6]

6.   The Analysis

6.1   Analyzing the Server's Data Live Output

We conducted DTE-4 by repeatedly exercising and recording a controlled operational scenario (simulated battlefield operations). In this series of DTE-4 "record runs," the server's standard console output was captured. This provided a stream of human-readable text describing the server's ability to perform most of the critical measurements described in the validation procedures listed in table 2. However, it provides no latency measurement. Furthermore, for evaluation purposes, all verbose validation tracing and "debugging" output options were activated. This significantly slows the server's processing, and thus it would not make sense to extract latency measurements during these conditions. Also, as pointed out in other findings (*8*), because of software layers and varying processing algorithms, truly meaningful interactive latency is not point to point (i.e., network node to network node) but rather application (on a network node) to application (on another network node). Application-to-application latency was not the focus in DTE-4; therefore, preparation (synchronizing clocks, implementing common time stamps for all applications) was not designed into the exercise nor enforced. Another final DTE-4 specific consideration regarding latency is that it can be viewed as not having any effect on the lethality server. This is because the server never actually broadcast the damage results onto the network and therefore, no application-to-application temporal measurements could be made.

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[5]STAFF is a top attack smart munition. It flies over an enemy system and fires an explosively formed penetrator into the lighter armored top. It is also effective against helicopter targets, but air targets would require a different table reader because of the way the data are organized. The server currently only handles ground targets.

[6]The server's basic software source code organization and directory structure is described in reference (*9*). Source code for these off-line tools is located in $VLS_HOME/src/TblReaders and $VLS_HOME/src/Tbl Readers/rdr in which $VLS_HOME is the folder or directory where the server was installed.

6.2　Nature of the Analyzed Data

It is important to understand the distributed test system architecture in order to place analyzed data in their proper context. In addition to the server's output that was captured during the live record runs of DTE-4, the server's input was also captured in the form of network traffic log files created at ATC. However, these logs were created from just the network traffic seen on the ATC node. They only contained distributed interactive simulation (DIS) protocol data units (PDUs) (*10*) and not HLA data structures (*11*). Since the server is an HLA application, these PDUs are less than ideal for a post-process analysis since they need to be translated to HLA and therefore will not necessarily reproduce the exact input observed during DTE-4, nor did they. This was the source for certain explained errors (see appendix D). Except for the locally generated ATC entities (vehicle dynamics mobility simulation, and robotics intelligence), all the logged DIS PDUs were generated by remote DIS (and in some cases, native HLA) applications. All DIS entities were then translated to HLA objects via the MaK[7] gateway, transmitted across the wide area network and then retranslated locally to the logged DIS PDUs. This is displayed in figure 4. These logged DIS PDUs were the input source during the server's validation re-runs.
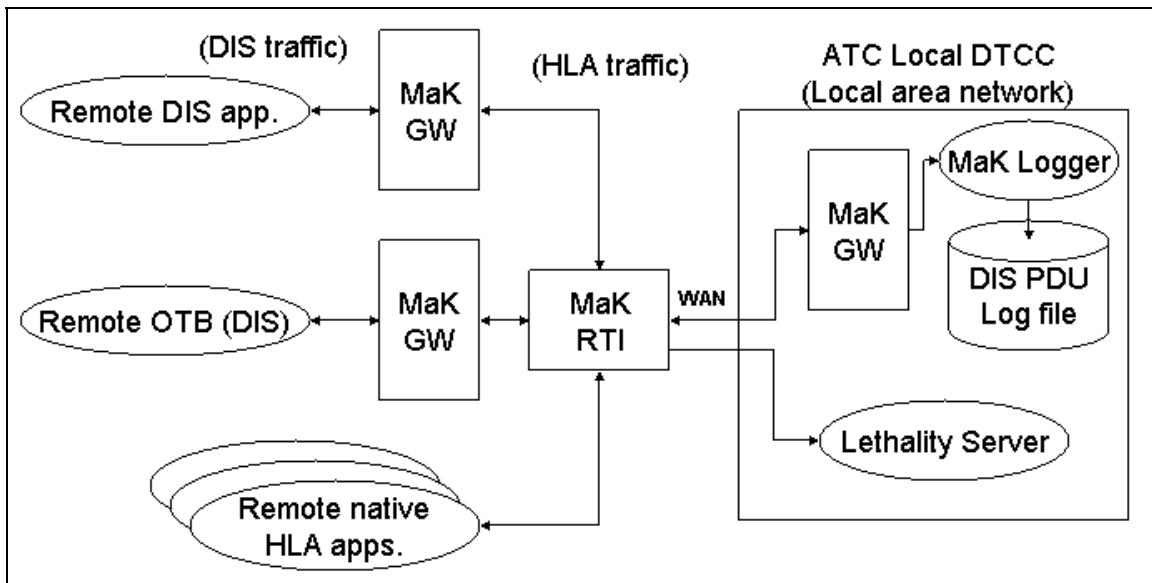
Figure 4. DTE-4 network architecture (from the ATC logged PDU perspective). (Other remote MaK gateways [not shown] were also joined to the MaK run time infrastructure [RTI].)

The server's "live" standard output that was recorded during DTE-4 execution and the logged playback files (server input) were used in this evaluation. These log files recorded hundreds of munition detonation events and *hundreds of thousands* of entity updates and other messages over the course of the approximate 90-minute scenario (appendix E).

The server's console (standard output) and log files were recorded for each of the DTE-4 record runs. Only the last record run was necessary to validate the server's performance. This log file

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[7]MaK, which is not an acronym, is the company name.

was also selected because the robustness of many DTE-4 components (and the server in particular) increased as the DTE-4 progressed (see PTR 9 where the server actually "crashed" in one instance). Therefore, the log that best represented the most current state of DTE-4 components was selected for analysis. For this record run, we examined the server's standard output first, followed by its input (the log file). This is in keeping with the validation procedures outlined in section 5.2; namely, we examined the output first (in this case, the live record output) and worked our way back to the input. This order revealed easily identifiable inconsistencies that were obvious from standard output error reports. Most of these problems were easily rectified. However, to solve some of the more subtle errors and verify all configured corrections, the log file was extensively employed.

6.3   Description of the Primary Input Records

The server monitors basically three types of HLA data components: (a) object updates for vehicle platforms (the "Platform" object) that describes the type of system, its position, velocity, and other state information; (b) descriptions of weapon fire events (the HLA WeaponFire interaction); and (c) munition detonation descriptions (the MunitionDetonation interaction). These are all described in the core object model used during DTE-4: the real-time platform-level reference (RPR) federation object model (FOM) (*12*). An example of the server's standard output that reflects data from one of the MunitionDetonation interactions is displayed in figure 5. The MunitionDetonation fields are described in the RPR FOM Guidance, Rationale, and Interoperability Manual (12, pp. 79-80) and in appendix F, table F-1.

```
   vector <DataElement *>  parameters= {
      DetonationLocation = -1531236.210672 -5187662.227535 3370985.947092
(WorldLocationStruct)
      DetonationResultCode = 0x01 (DetonationResultCodeEnum8)
      EventIdentifier = 6 "Gateway"  (EventIdentifierStruct)
      FiringObjectIdentifier = "300:8:1223gw"  (RTIObjectIdStruct)
      FinalVelocityVector = -292.482697 49.471294 -53.837307
(VelocityVectorStruct)
      FuseType = 0 (FuseTypeEnum16)
      MunitionObjectIdentifier = ""  (RTIObjectIdStruct)
      MunitionType = 0x02 0x02 225 0x01 0x01 0x00 0x00 (EntityTypeStruct)
      QuantityFired = 1 (unsigned short)
      RateOfFire = 0 (unsigned short)
      RelativeDetonationLocation = -0.043465 -0.261724 -1.748757
(RelativePositionStruct)
      TargetObjectIdentifier = "300:8:1240gw"  (RTIObjectIdStruct)
      WarheadType = 1600 (WarheadTypeEnum16)
   } // end vector <DataElement *>  parameters
```

Figure 5. Observed MunitionDetonation example.

6.4   Collecting the Verification Input Data

6.4.1 Missed Detonations

Tools automatically scanned the server's standard output to create a database of all WeaponFire and MunitionDetonation interactions as they were seen by the server (validation procedure P1 from table 2). During the final run for record, the server reported seeing 366 WeaponFire and 378 MunitionDetonations. The good news is that the server was confirmed to *correctly read* all the records that it saw (meaning that each of the parameters within an event that the server expected to see was present and read correctly). The bad news is that the server missed about 12% of these critical events! This is a totally unacceptable measure, especially when one considers that the server must process 100% of the detonations (requirement R1, table 1), missing none. This data drop rate was confirmed during the log replay and server verification process. The cause was related to the server being in "debug" mode. It probably spent most of its processing time writing to files and the standard output. During these busy periods, the server missed 12% of the fire and detonation events. These events were sent "best effort," meaning the sender (HLA federate) broadcast notice of the event and made no attempt to confirm that the message was ever received. Both issues were addressed and resolved in PTR 6. The solution described there is to (a) turn off the server's "debug mode" during a record run so that it is much less likely to ever miss a critical event, and *most importantly* (b) set event notifications to a "reliable" mode to guarantee receipt. With change 2 in place (and while still in debug mode), the server was able to capture 100% of the published detonations (see appendix F).

6.4.2 Uncorrelated Weapon Fire Events

The RPR FOM WeaponFire interaction alerts simulation participants when a weapon fires, while the MunitionDetonation alerts when the detonation occurs.[8] The eventIdentifier field, seen on the fourth line of figure 5, is used to uniquely identify a WeaponFire event and associate it with a related MunitionDetonation (i.e., the eventIdentifier for a related WeaponFire and Munition Detonation should be equal).[9] Unfortunately, there was an error following the RPR FOM specifications in the identification of WeaponFire and MunitionDetonation events (filling the "eventIdentifier" field). This error originated from the MaK gateway (during its translation of received PDUs to HLA) or from other HLA applications that generated the eventIdentifier or stemmed from the original translated DIS PDU. (In the case of DTE-4, OTB generated most of the original fire and detonation DIS PDUs.) Regardless of the source of the error, a consistent observation is that the eventIdentifiers produced by the MaK gateway are basically incremental.

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[8]"...WeaponFire contains sufficient information so that the weapon may be tracked off line without creating a corresponding Munition. The MunitionDetonation interaction alerts simulation participants when the weapon is detonated, and includes information used in battle damage assessment models" (reference R5, p 78).   Also see figure 5 in this report, a MunitionDetonation record example and appendix F.

[9]The EventIdentifier is an "...ID generated by the firing entity to associate related fire and detonation interactions" (reference R5, tables 7-4 and 7-5, pp 78-80)

For example, the gateway issued a WeaponFire with eventIdentifier "6, Gateway" followed shortly thereafter by a coorresponding MunitionDetonation with eventIdentifier "7, Gateway," whereas one would expect to see "6, Gateway" for *both* the WeaponFire and related MunitionDetonation. Another observation is that EventIdentifier occasionally re-started their identifier sequence (e.g.. "52, Gateway," "53, Gateway," "54, Gateway," …. "1, Gateway," "2, Gateway," "3, Gateway"…). Perhaps this was because the HLA federate generating them was re-started or recycled and therefore began issuing identifiers from its initial starting point. This re-sequencing was only observed in the server's captured live DTE-4 output. During the live DTE-4 exercises, the gateway was occasionally re-started by operator request, at RTTC and other test center locations, and this would explain the re-sequencing observation. However, when the server (and MaK gateway) was stimulated with the log file, this re-sequencing was never observed and EventIdentifiers monotonically increased (as can be seen in appendix F, table F-2, column 2).

The result was that we could not automatically pair WeaponFire events with their related MunitionDetonation events. Not being able to pair fire and detonations meant that the exact firer-to-target range could not be determined for certain munitions that required it for a lethal assessment. Fortunately, a backup measure is built into the server which is automatically triggered in such a case; namely, the firer-target range is calculated at the time of the detonation (which is not going to be accurate if either the firer or target is moving). It requires a firer to be identified which (fortunately) was the case for the detonations (see `FiringObjectIdentifier`, fifth line of figure 5).[10] This backup measure has more than enough range calculation precision because of the granularity of the vulnerability data used as well as the munition velocity granularity produced by OTB (the primary weapon fire simulation). Thus, WeaponFire events were not used and are not recorded in this report, although they were all read correctly and processed without incident by the server.

6.5 Validation Spirals

We have completed an examination of the live output and adjusted for identified problems (missed detonations, uncorrelated fire events). In keeping with the process outlined in figure 3 and following the validation procedures outlined in table 2, we started with the live (standard) output captured during the actual DTE-4 exercise but quickly exhausted most of the issues that could be solved by its study (addressed in sections 6.4.1 and 6.4.2). The only other notable measurement made with the live exercise's output was the "entity count." If all data were being transmitted and accounted for properly, then OTB, the MaK gateway, and the lethality server (see figure 4) should be tracking the same set of entities. An attempt was made to verify the

---

[10]In many cases, the firer was not identified (column 4 "FiringObjectIdentifier", table F-2, appendix F). Therefore, the server was unable to determine the critical range-to-target input parameter in these cases. This of course was the fault of the issuing HLA federate for not filling the "FiringObjectIdentifier" field (and not the fault of the server). Also these cases represented indirect fire munitions (e.g., mortars) that the server does not currently service and are therefore disregarded from the validation requirement (see the note at the bottom of table 1).

"entity count" among these three applications during the exercise (and in post-exercise replays). However, accounting differences and the way the applications selectively filter entities made this seemingly simple statistic complicated to track. In the end, we were satisfied that the server saw the same entities that were tracked by the other applications (appendix G). However, we recommend that accounting and filtering differences be understood before a simulation execution.[11]

We then executed a series of validation spirals using log files played back to stimulate the server. In each spiral, the output was examined and if an error or other issue was identified, it was registered in the problem tracking and resolution process as a PTR and a solution was sought. More than 20 playbacks were analyzed in this controlled manner. Along the way, in-depth details are provided regarding how certain PTRs were solved. Some of these details have already been cited, namely, a detailed verification of the table look-up algorithms (appendix B) and solving why the server occasionally could not complete a vulnerability look-up because it did not have all the input (appendix D). By far, however, the source of most of the repaired problems originated from the server missing look-up tables or target identifiers before execution (a data configuration issue). These changes were straightforward and are succinctly addressed in PTRs 18a, 24, and 25 with far greater details also available (appendix H).

In one case, unrecognized (target) entities were a result of related software problems that were addressed and corrected in PTRs 10, 11, 15a, and 21. The root problem's diagnosis and resolution is described in greater detail in appendix I.

7. Summary

In summary, functional requirements for a distributed lethality service were defined in table 1. The server's live DTE-4 output (as well as output stimulated by replayed DTE-4 log files) was analyzed against meeting these requirements. The server met the requirements with 100% success after numerous issues were addressed and documented. Issues and their resolutions are explained further in the appendices. Validation procedures applied during the analysis were documented in section 5.2.

Based on the requirements, validation procedures, and issues identified in this report, a pre-scenario-execution checklist was developed and is provided in section 8. This checklist is intended to be a "living document" whose initial version is published here.

---

[11]The process of confirming that entities are properly tracked is institutionalized as part of the server pre-execution checklist.

8. Recommendations

The Software Engineering Institute Capability Maturity Model Integration (CMMI) provides guidance for use when one is developing and institutionalizing processes (*13*). CMMI defines an "organization's process asset library" as a resource used to make available assets that are potentially useful to those who are defining, implementing, and managing processes. Among the examples of process-related documentation cited in CMMI is a simple checklist.

The following checklist is intended to be a "living document" that should be added to as required. By following and maintaining the table 3 checklist, we can learn valuable lessons that may be captured into a standard process. This will help ensure repeatability in delivering a product (a lethality service) at its highest quality.

9. Conclusion

In conclusion, the server demonstrated that it could achieve all it was required to do. On rare occasions, the server could not provide a damage outcome (because another component was unable to do what it was required to do); however, "work-arounds" have been incorporated into the lethality server pre-exercise checklist to avoid this. This serves as a reminder of how important it is to understand the entire system when one is operating in a distributed environment.

Ideally, V&V should be independently performed (and not by system developers). However, the advantages in this case included being able to immediately resolve validation issues, document the software's current state, and provide a V&V process to streamline any future V&V effort. In addition, valuable lessons learned have been institutionalized into our process through a pre-exercise checklist.

Table 3. Lethality service pre-exercise checklist.

Lethality Service Pre-Exercise Checklist, V1.0

1) Obtain object model descriptions (HLA FOM) early.
    a. Software may have to be modified to interface with the distributed environment and this may require a long lead (early start).
    b. If possible, work within the federation development process (FEDEP) to communicate server data requirements and FOM interface.
2) Obtain a listing of scenario entity participants (target platforms and munition threat types).
    a. Each entity shall require a unique DIS enumeration (IEEE 1278.5)
3) Obtain the most current vulnerability data source (tables)
    a. Ideally, all munitions should be paired against all types of entities in the scenario. However, it is understood that certain pairings will have a low probability of encounter.
        i. Present to the accreditation authority the knowledge base regarding validation and pedigree for all existing data (tables).
    b. Identify (explicitly list) threat-target pairings that do not have a vulnerability data source (table).
        i. Present this listing to the study proponent or accreditation authority for acknowledgment and possible resolution.
4) Populate the server's database
    a. Update the server's database to reflect the exercise scenario with the most current vulnerability tables.
5) Final pre-run checks
    a. Exercise available off-line "test harness" tools to verify that data sources are accessible and being processed correctly
    b. Stimulate the server on line using the planned exercise scenario
        i. Verify that all entities are being tracked properly.
        ii. Verify that all detonation and appropriate weapon fire events are observed and processed.
        iii. Address any shortfalls and report their resolution to the accreditation authority.
    c. Configuration Management (CM): Though this is to have been regularly maintained throughout the development, ensure that all revision control check-ins have been made for source code and the vulnerability data.
6) Run-Time Checks:
    a. Upon a gateway or other HLA federate restart (recycle): pause the simulation execution for several entity update cycles and ensure that all entities are updated before resuming the simulation. Reference PTR 14.

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Appendix A. Program Trouble Reports (PTRs)

The ARL lethality table lookup server software development and maintenance processes have not been independently evaluated for a CMMI classification level. Yet many SEI CMMI software engineering level-2 processes are adhered to (0). These include revision control and requirements management processes. A tool that relates to both these is the server's problem tracking and resolution process. When a problem arises a PTR is registered. The PTR is basically a data structure used to capture significant aspects of the problem. PTRs are then incorporated into the software revision control and requirements maintenance processes to ensure that:

      1. Problems being repaired actually address software requirements.
      2. Software revisions reflect solutions identified in the PTRs and that
      3. Any identified changes to the server requirements are addressed in future software revisions along with the reasons for the change.

A PTR's severity is classified as "high" if it blocks the server from achieving any of its critical software requirements. The PTR basic format is borrowed from the PTR process and system adopted by MATREX (0) with the PTR fields modified to suite the lethality server. These fields are meant to be self explanatory.

This appendix provides a list of server PTRs identified during and in the DTE-4 post operation analysis phase. They contain a spectrum ranging from highly severe erroneous behavior and needed data configuration changes to (on the other end of the spectrum) items that are deem "nice to have" (but not critical). The level of detail given in the PTRs is intended to provide a technical understanding of the problem.

PTR#		1	Title	"cout" violation
Status:	Closed		Date	Mon Aug 16 13:34:59 EDT 2004
Severity:	High - indicates memory overwrite			
Category:	Coding error			
Short Description	cout is overwritten			
Further Details	cout is: 0x810ae6c by the time I get to queue_report(void), >queue_report(void) cout is: 0 This happens after any WeaponsFire or MunitionDetonation. if calls to hWeaponsFire() and hMunitionDetonation() are commented out, then no such error occurs. Comment: Tue Aug 17 11:50:51 EDT 2004 this starts when msHLA->ascii_Interaction() is called with an unfound object name. msHLA->ascii_Interaction("InteractionRoot.WeaponFire") *all is well* vs msHLA->ascii_Interaction("WeaponFire") *count is 0*			
Resolution Date	Tue Aug 17 12:08:44 EDT 2004			

Resolution Description	Noted that first ascii_Interaction() call worked, second bombed and set cout to 0.
	cout <<"---" << endl;
	cout << msHLA->ascii_Interaction("InteractionRoot.WeaponFire") << endl;
	cout <<"--see:-" << endl;
	cout << msHLA->ascii_Interaction("WeaponFire") << endl;
	cout <<"--done" << endl;
	
	ascii_Interaction() returns NULL when the interactionName is not found:
	
	const char *FOM_Object::ascii_Interaction(const char *interactionName)
	{ const char *ret;
	    SOM_Interaction *asim;
	    asim = _sims_get(interactionName);
	    if (asim!=NULL)
	        ret = asim->ascii();
	    else
	        ret = NULL;
	  return ret;
	}
	
	the Interaction name that is used must be the same as that used in the .HLAfc file.			

Notes				

PTR#	2	Title	N/A
Status:	closed	Date	
Notes	There is no PTR 2.		

PTR#	3	Title	rmobject() memory leek
Status:	close	Date	17 August, 2004
Severity:	High		
Category:	Coding Error		
Short Description	Objects resigning from the federation are not removed from the server.		
Further Details	When deleting objects from the hashmap, the FOM_Objects were never destroyed.		
Resolution Date	Adding code to HLAmon.RPR_FOM to handle deletion.		
Resolution Description			
Notes	NOTE: This applies to HLAmon.MATREX since I am starting from the MATREX federation my_hla_read.cc code base.		

PTR#	4	Title	Obsolete function
Status:	closed	Date	Tue Aug 17 08:43:31 EDT 2004
Severity:	Low		
Category:	Nice to have – but not critical to behavior		
Short Description	see if we can remove ms_DiscoveredEntitiesFOM_Object_ByStringID[]		
Further Details			
Resolution Date			08/17/04
Resolution Description	Cleaned-up ms_DiscoveredEntitiesFOM_Object_ByStringID[] and I see that it (this container) is really not needed. (I think may wish to remove it after all checks out).		
Notes			

PTR#	5	Title	Internal Variable name change
Status:	Close	Date	Tue Aug 17 10:10:00 EDT 2004
Severity:	Low – added for clarity, to avoid coding confusion		
Category:	Coding change - for efficiency or risk management		
Short Description	Internal Variable name change - ms_RPRFOMids_2_RTIObectInstanceHandle is ambiguous		

Further Details	change ms_RPRFOMids_2_RTIObectInstanceHandle
	name to
	    ms_DiscoveredEntitiesInstanceHandle_ByObjectInstanceName
	
	created
	    ms_FOMSpecificStringIdentifier_ByInstanceHandle[]
	    To map things like the RPR_FOM's "123.32.45." <-> 1232132		

Resolution Date	17 August, 2004		
Resolution Description			
Notes			

PTR#	6	Title	Missed updates
Status:	closed	Date	Mon Aug 23 09:51:34 EDT 2004
Severity:	High – we can miss some, but not too many state updates		
Category:	FOM / network configuration / some programming		
Short Description	When playback is run fast, (best effort) entity updates might be getting missed		
Further Details	I am getting "<NOT INIITALIZED>" for many of the entities' attributes Maybe queuing an entity update request might help. Also this should be retested after removing the verbose debugging print and cout's.		
Resolution Date	Date: 05 Oct 2004: 1030		
Resolution Description	A balance must be determined and made between occasionally missed updates and critical interactions. Fire/Detonation events need to be set as "reliable" in the .fed file. All server debugging output and logging needs to be "off" to reduce processing overhead (and reduce the number of missed updates. In addition the following federate data items should be transmitted reliably to ensure receipt: in the fed file SEIT.fed: (ensures receipt of all fire and detonations) (class WeaponFire reliable timestamp (class MunitionDetonation reliable timestamp in the "rid" file ATCSEITRID.mtl: (ensures object discoveries) ;; Enable reliable transport for internal and/or FOM (e.g., update, reflect, ;; delete, and interactions) messages. Requires the rtiexec process (setqb RTI_internalMsgReliable 1)		
Notes	PTR 14 provided main fix. PTR 7 is related.		

PTR#	7	Title	Better verification data written faster.
Status:	Open	Date	Mon Aug 30 11:46:59 EDT 2004
Severity:	Low		
Category:	Optimization		
Short Description	Verification output needs to be placed in a data file rather than standard output.		
Further Details	Need write VL_Params to a data record (not just stdout). Include results of the table lookup. (error messages). When the VL_RSLT_ERR_NO_TABLE occurs. A special record should be created. perhaps in a different file. This will indicate that a table (data source) needs to be found for the identified target, threat, and the vulnerability method used. If a threat or target is unknown (DIS enumeration not known) that should be noted.		
Resolution Date			
Resolution Description			
Notes			

PTR#		8	Title	Weapon Fire event accounting inconsistency
Status:	Closed		Date	Aug 30 17:37:14 EDT 2004
Severity:	Medium			
Category:	Singular event – unexplained behavior			
Short Description	Unexplained accounting (tracking of) Weapon Fire events.			
Further Details	after completing SEIT DTE-4 afternoon run for record today, the LV server reported number of observed weapon fires [414] not equal to the number of mapped weapon fire events [280] (an internal tracker containing weapon fire records). These numbers should be equal. ``` entities tracked : 15 mapped events to weapon fires: 280 weapon fires seen(should ==^): 414 detonations seen : 265 unprocessed detonations : 0 Objects Tracked in middleware: 17 ```			
Resolution Date				10/22/04

Resolution Description	We conclude that this was the due to a "misbehaving program"
	
	As the code expert below shows, this can only happen if the weapon fire "event" field was not filled (or repeated with the same data) by an issuing application, or if the server received no data for the fire event field. This would cause reoccurring strings resulting from the "strdup()" call (and hence, a lower count for "mapped events". This observation was not recorded again, so we conclude the fire event issuing program was repaired. LV server "my_hla_read.cc" excerpt:
	
	``
	wf = new WeaponFire;
	_updateFromMiddlewareWeaponFire(wf, msHLA); // fills
	"wf" data atribs.
	EventHandleWrapper* evp = new EventHandleWrapper((wf-
	>EventIdentifier));
	
	ms_observerdWeaponFires.push_back(evp);
	ms_EventHandleWrapperStr_2_WeaponFire[strdup(evp-
	>toString())] = wf;
	
	//....later these are used to print the statistics above:
	        cout << "mapped events to weapon fires: " <<
	ms_EventHandleWrapperStr_2_WeaponFire.size() << endl;
	        cout << "weapon fires seen(should ==^): " <<
	ms_observerdWeaponFires.size() << endl;
	``			

Notes				

PTR#	9	Title	LV Server crashed !
Status:	Closed	Date	31 Aug 200
Severity:	High		
Category:	Coding error.		
Short Description	Server crashed during DTE-4 run.		
Further Details	Crashed when removing object without an RTIObjectInstanceName (provided by RTI).		
Resolution Date	1 Sep 2004		
Resolution Description	That is, the RTI created an object without providing a name (text string) as it should (likely because another HLA federate created an object without providing a text "name" as require). When it came time to delete the object, the server expected a string to be were there was none. The error was caused by passing a NULL string or a "" empty string (with multiple instances) to the STL::hash_map.find() when remove object was called. Code was added to make the server more robust an handle this occurance. After Fixing this the Lvserver never crashed again during the last 2 days (1-2 sep) of SEIT DTE-4.		
Notes			

PTR#	10	Title	Mis-reported Error
Status:	Closed	Date	2 Sep 2004
Severity:	Medium		
Category:	Confusing behavior		
Short Description	Server reports "target unknown", but it is actually a Threat that is not known.		
Further Details	Example Excerpt from the standard output: ``` -- DAMAGE RESULT was: -2 (or "M_KILL" Vulnerability not determined! - there were errors! Error was code (4): VL_RSLT_ERR_UNKNOWN_TARGET Probability distribution: <none> -- #--------------------V/L-Parameters--------START------ # #------------dbEntity Coordinate System: EQS #------------World Coordinate System : WQS # # PARAMTER VALUE VLP_ang_aspect 1.957169 (112.137543 degrees) EQS VLP_ang_attack -0.009947 (-0.569940 degrees) EQS VLP_impact: 0.121652 0.030240 -1.583664 x y z (meters): EQS VLP tvel: 405.787262 476.605316 904.535278 x y z (m/s) WQS VLP_range 559.539490 (meters) WQS (if 0, then unknown) VLP_target_id = 300 8 1305 (site, application, entity id) VLP_target_type = (1,1,222,2,2,1,0) (" BMP-2"," BMP-2",) VLP_threat_type = (2,2,225,2,3,7,0) ("" , "" , "") VLP_firer_type = (1,1,225,2,1,4,0) (" FMC M2/M3 Bradley",) ```		

	``` VLP_result = 1 (Entity Impact) VLP_DetEventID = (0 0 764) #-------------------V/L-Parameters--------END-------- ```
Resolution Date	28 September 2004, 29 September 2004.
Resolution Description	Note: verified that tgt is known. (1,1,222,2,2,1,0) (" BMP-2"," BMP-2",) Note: the unknown threat: (2,2,225,2,3,7,0) (highlighted in the "Further Details" section of this PTR) should have appeared as "UNKNOWN" if indeed there was no description of that entity in the enumerations database. Yet, by visual inspection (which could be flawed) "(2,2,225,2,3,7,0)" could not be found in the database. To ensure that the target is a "known" and that "(2,2,225,2,3,7,0)" has an entry, the following entity DIS enumeration record "(2,2,225,2,3,7,0)" was added. 29 September: Following this change and in subsequent log file playbacks, the target was still reported as VL_RSLT_ERR_UNKNOWN_TARGET however, this reported error was known to be incorrect since the target was identified as the added DIS enumeration record indicated. The solution was completely resolved when the software changes shown in PTR 12 took effect. The mis-reported error was generated from a previously issued error report and hence, out of synchronization with the root cause of the problem which was a missing vulnerability table: ``` VLP_target_type = (1,1,222,2,2,1,0) (" BMP-2"," BMP-2",) VLP_threat_type = (2,2,225,2,3,7,0) ("" , "" , "") ```
Notes	11 Nov 2004: Postscript: The missing vulnerability table was addressed in the 4th target-threat pairing listed in PTR#24.

PTR#		11	Title	Server reports odd returned lookup result
Status:	Close		Date	28 Sep 2004
Severity:	Low			
Category:	Confusing output			
Short Description	Damage result makes no sense example: DAMAGE RESULT was: -2 (or "M_KILL"			
Further Details	See PTR 10 example output "DAMAGE RESULT was: -2 (or "M_KILL"" it should read something like: "DAMAGE RESULT was: -2 (or "PS_ERROR")" Damage result code is not a kill-level code.			
Resolution Date	28 September 2004			

Resolution Description	Error Identified: (coding patch to my_hla_read.cc)
	
	    str_VL_RESULT_FLAG(result) was used to interpret the returned result.
	
	Resolution:
	
	    Instead use vl_result_str(result) to print the string interpretation of the returned result.			

Notes				

PTR#		12	Title	Server cannot solve for high explosive round if firer is not known.
Status:	Closed		Date	09/29/04
Severity:	High – impedes functioning 100% of the time.			
Category:	Coding error.			
Short Description	The server should be able to provide a solution for high explosive (HE) rounds just knowing the target and threat (munition). It doesn't need the firer. VL APIs require knowing where the firer shot the round.			
Further Details	vlparam.c: vlp_setp_all_Munition_Frm_DIS() Problem: the API returns (with out sufficient error reporting if any entity state [firer, target, detonation] is NULL). In many high explosive munition (HE) cases, we don't need to know the firer's location (in order to determine range). The Firer's ID (and fire PDU) is only used to determine range. Range is not a parameter for HE ANTI Tank rounds.			
Resolution Date	29 Sep 2004			

Resolution Description	Code modified (in vl.c library) so that the table lookup does not abort if firer is a NULL pointer (but it does report that fact using _rpt_error()).
	
	Namely in $VLS_HOME/src/Lib/Vlapi/vl.c: lines 100-101 were changed from:
	
	100 if (firer == NULL || tgt == NULL || det == NULL) {
	101 ++error;
	...
	
	to
	
	100 if (tgt == NULL || det == NULL) {
	101 ++error;			

Notes				

PTR#		13	Title	Target type not set properly.
Status:	Closed		Date	04 Oct 2004: 1555hrs
Severity:	High			
Category:				
Short Description	vlp_setp_all_Munition_Frm_DIS() does not set Target type properly (or range, but in this case we do not know range since we don't have a fire PDU).			

Further Details	(Example from DTE4 data log: 300:8:1221gw firing on 300:8:1257gw)
	eventID - varies depending on when log is started:
	could this be an endian problem?
	
	`VLP_range          6373379.000000    (meters)        WQS`
	`(if 0, then unknown)`
	`VLP_target_id = 50307 60176 36319  (site, application,`
	`entity id)`
	`VLP_target_type = (131,196,60176,223,141,118,0) (*UNKNOWN*`
	`entity enumeration!)`			

Resolution Date	05 Oct 2004: 1000			
Resolution Description	This is likely a result playing back a log file to a point of interest. If the target (which is stationary) has not sent an HLA position update since prior to its discovery, then its position is not known. (undefined derivations of items such as): `VLP_range          6373379.000000    (meters)        WQS`			

<table>
<tr><td rowspan="1">

```
(if 0, then unknown)
 VLP_target_id = 50307 60176 36319  (site, application,
entity id)
 VLP_target_type = (131,196,60176,223,141,118,0)
(*UNKNOWN* entity enumeration!)
Fix:
 Date: 05 Oct 2004: 1000
 the possible fix was correct.  - RESOLVED.  But I am adding PTR 14

    vector <DataElement *>  parameters= {
        DetonationLocation = -1531236.113070 -5187662.615902
3370985.329899
(WorldLocationStruct)
        DetonationResultCode = 0x01
(DetonationResultCodeEnum8)
        EventIdentifier = 12 "Gateway"
(EventIdentifierStruct)
        FiringObjectIdentifier = "300:8:1216gw"
(RTIObjectIdStruct)
        FinalVelocityVector = -293.000519 57.890354 -
41.126778
(VelocityVectorStruct)
        FuseType = 0 (FuseTypeEnum16)
        MunitionObjectIdentifier = ""  (RTIObjectIdStruct)
        MunitionType = 0x02 0x02 225 0x01 0x01 0x00 0x00
(EntityTypeStruct)
        QuantityFired = 1 (unsigned short)
        RateOfFire = 0 (unsigned short)
        RelativeDetonationLocation = 0.000577 0.155480 -
1.769039
(RelativePositionStruct)
        TargetObjectIdentifier = "300:8:1240gw"
(RTIObjectIdStruct)
        WarheadType = 1600 (WarheadTypeEnum16)
} // end vector <DataElement *>  parameters
```

</td></tr>
</table>

Notes	6 Oct. PTR reopened. - NOT FIXED. see: PTR14.

PTR#		14	Title	Re: Target type not set properly.
Status:	Closed		Date	10/06/04
Severity:	High			
Category:	Code or Data – Impends ability to function correctly 100% of the time.			
Short Description	Re-opened PTR 13			

Further Details	<pre> vector <DataElement *> parameters= {
	     DetonationLocation = -1531236.113070 -5187662.615902
	3370985.329899
	(WorldLocationStruct)
	     DetonationResultCode = 0x01
	(DetonationResultCodeEnum8)
	     EventIdentifier = 12 "Gateway"
	(EventIdentifierStruct)
	     FiringObjectIdentifier = "300:8:1216gw"
	(RTIObjectIdStruct)
	     FinalVelocityVector = -293.000519 57.890354 -
	41.126778
	(VelocityVectorStruct)
	     FuseType = 0 (FuseTypeEnum16)
	     MunitionObjectIdentifier = "" (RTIObjectIdStruct)
	     MunitionType = 0x02 0x02 225 0x01 0x01 0x00 0x00
	(EntityTypeStruct)</pre>			

```
        QuantityFired = 1 (unsigned short)
        RateOfFire = 0 (unsigned short)
        RelativeDetonationLocation = 0.000577 0.155480 -
1.769039
(RelativePositionStruct)
        TargetObjectIdentifier = "300:8:1240gw"
(RTIObjectIdStruct)
        WarheadType = 1600 (WarheadTypeEnum16)
} // end vector <DataElement *>  parameters
```

See example standard output. The target is definitely identified above in the Munition Detonation interaction. However, when interpreted by the server, the server is unable to resolve the target:

```
==========AT THIS POINT THE Lethality server would
broadcast=========
------------------------------------------------------------
-------------
DAMAGE RESULT was: -2 (or "PS_ERROR"
Vulnerability not determined!    - there were errors!
 Error was code (1): VL_RSLT_ERR_NO_TABLE
unknown THREAT: (2,2,225,1,1,0,0)
Probability distribution: <none>
------------------------------------------------------------
-------------
#--------------------V/L-Parameters--------START------
#
#------------dbEntity Coordinate System:  EQS
#------------World Coordinate System :  WQS
#
#   PARAMTER           VALUE
VLP_ang_aspect    0.211488  (12.117380 degrees)    EQS
VLP_ang_attack    0.617644  (35.388409 degrees)    EQS
VLP_impact: 0.000577 0.155480 -1.769039 x y z (meters):
EQS
VLP_tvel:   -293.000519 57.890354 -41.126778 x y z (m/s)
WQS
VLP_range         6373379.500000   (meters)        WQS
(if 0, then unknown)
VLP_target_id = 50307 60176 36319 (site, application,
entity id)
VLP_target_type = (131,196,60176,223,141,118,0) (*UNKNOWN*
entity enumeration!)
VLP_threat_type = (2,2,225,1,1,0,0)     (" BGM-71 TOW",, )
VLP_firer_type = (1,1,225,2,1,6,0)     (" FMC M2/M3
Bradley",)
VLP_result = 1    (Entity Impact)
VLP_DetEventID = ( 0 0 12 )
#--------------------V/L-Parameters--------END--------
```

Resolution Date	Mon Oct 18 16:08:06 EDT 2004
Resolution Description	The root cause of this problem is that the target entity was removed from the federation (perhaps because it was timed-out, or its gateway restarted) and later the entity rejoined the federation. When it rejoined, it had no state data. Unimplemented Software solution 1: Re-Opened: a final (FOM specific fix) is to have a permanent list of entity types mapped to the EntityID's "300:8:1256gw" (a RTIObjectIdStruct datatype). Thus when the target is identified (TargetObjectIdentifier = "300:8:1256gw" (RTIObjectIdStruct)) will then be a quick lookup in the even that there is no entity type. If the mapped entity type still makes no sense, request an update for that entity accepting the updated entity type field as the

	new permanent list entry. Unimplemented software solution 2: Used in conjunction with the identified process solution below. Add the "request for attribute updates" HLA service call. Attach this service to a button or command interface to force federates to provide an update. This will be activated during the process resolution (below) until the server has seen an update of critical parameters (entity type and position) from all entities. This solution requires that all federates implement the "provide attribute update" HLA service into their federate. Process solution: This is a less acceptable solution since there remains the possibility of the server missing the entity's state data update when it rejoins the federation. Process: upon any federate restarting (recycling), pause the federation execution for several entity update cycles. This will make it less likely that the server will miss all entity updates for the rejoined entities.
Notes	Postscript: See PTR 21. Software solution 2 is partially implemented. (the command/button interface and update verification check remains unimplemented).

PTR#	15	Title	Expose lookup table
Status:	Closed	Date	Date: 05 Oct 2004
Severity:	Low – doesn't effect functionality. But will greatly aid in validation.		
Category:	Validation		
Short Description	Need to expose the lookup table (or data source).		
Further Details	This will help verify that the server is going to the correct lookup table (data source).		
Resolution Date	Date: 05 Oct 2004: 1130		
Resolution Description	Added the Data Dictionary element: VLP_dataSourceURL it is set upon successful (or unsuccessful lookup). touched: db_tbl_result_func() (where VLP_dataSourceURL is set). touched: vlparam.h & vlparam.c Output will now appear as: `VLP_dataSourceURL = "file:/... some url"`		
Notes			

PTR#	15a	Title	A known threat reported as "UNKNOWN"
Status:	Close	Date	Wed Oct 6 16:54:47 EDT 2004
Severity:	Medium		
Category:	Cosmetic – (hopefully)		
Short Description	Why is threat reported as unknown, when I think a TOW is defined. The real error may be VL_RSLT_ERR_NO_TABLE, but it needs to be investigated.		
Further Details	From some example output, note "unknown THREAT: " statement. And yet it *is* known to be a TOW missile. On the other hand the target is not known and should be reported as such. ==========AT THIS POINT THE Lethality server would broadcast========== --- DAMAGE RESULT was: -2 (or "PS_ERROR" Vulnerability not determined! - there were errors! Error was code (1): VL_RSLT_ERR_NO_TABLE unknown THREAT: (2,2,225,1,1,0,0) Probability distribution: <none> --- #--------------------V/L-Parameters--------START------ # #------------dbEntity Coordinate System: EQS #------------World Coordinate System : WQS # # PARAMTER VALUE VLP_ang_aspect 0.211488 (12.117380 degrees) EQS VLP_ang_attack 0.617644 (35.388409 degrees) EQS VLP_impact: 0.000577 0.155480 -1.769039 x y z (meters): EQS VLP_tvel: -293.000519 57.890354 -41.126778 x y z (m/s) WQS VLP_range 6373379.500000 (meters) WQS (if 0, then unknown) VLP_target_id = 50307 60176 36319 (site, application, entity id) VLP_target_type = (131,196,60176,223,141,118,0) (*UNKNOWN* entity enumeration!) VLP_threat_type = (2,2,225,1,1,0,0) (" BGM-71 TOW",,) VLP_firer_type = (1,1,225,2,1,6,0) (" FMC M2/M3 Bradley",) VLP_result = 1 (Entity Impact) VLP_DetEventID = (0 0 12) VLP_dataSourceURL = <null> #--------------------V/L-Parameters--------END--------		
Resolution Date			10/06/04
Resolution Description	FIXED: it was a mislabeled print statement in my_hla_read.cc		
Notes			

PTR#	15b	Title	Logger Configuration
Status:	Closed	Date	Date: 07 Oct 2004
Severity:	Low – doesn't affect functionality. Effects analysis		
Category:	Validation		
Short Description	MaK logger has a "play loop" feature. Make sure it is turned off.		
Further Details	Most of the re-runs had "play loop" turned on, thus I had repeated detonations and a general mis-count of fires and detonations.		
Resolution Date	2004 Oct 07		
Resolution Description	Pull-down menu "options", make sure loop-play is "off".		
Notes			

PTR#	16	Title	Formatting in one of the Debug output files.
Status:	Closed	Date	10/12/04
Severity:	Low		
Category:	Inconsistency		
Short Description	PTR 11 was not applied to a printout of result code that is sent to the debug file ("vlserver_debug2.out")		
Further Details			
Resolution Date			10/12/04
Resolution Description	resolution same as PTR 11.		
Notes			

PTR#	17	Title	Found (non-existing) data table !?
Status:	USB	Date	Wed Oct 13 13:12:13 EDT 2004
Severity:	High		
Category:	USB – ("unduplicated suspicious behavior")		
Short Description	misreported finding data table for non-matching threat-target.		

Further Details	Lserver reports a matching table when I know there should be none:
	Symptoms:
	`VLP_target_type = (1,1,222,1,2,2,0)    (" T-72 MBT"," T-72M", )`
	`VLP_threat_type = (2,2,225,2,3,7,0)    ( "" , "" , "" )`
	both these are in the list of known entities but there is no combination of this threat-target in the meta data file and yet the server reported actually finding a table (`dfdam_df1_3V2001.rdr`) and processed it:
	
	`Vulnerability determined SUCCESS - no errors.`
	`Probability distribution: 0.000000 0.100000 0.100000 0.100000 1.000000`
	`------------------------------------------------------------`
	`------------`
	`#--------------------V/L-Parameters--------START------`
	`#`
	`#-------------dbEntity Coordinate System:  EQS`
	`#-------------World Coordinate System :  WQS`
	`#`
	`#  PARAMTER         VALUE`
	`VLP_ang_aspect    5.316593  (304.618317 degrees)    EQS`
	`VLP_ang_attack    0.006391  (0.366203 degrees)     EQS`
	`VLP_impact: 1.153606 0.794216 -2.014180 x y z (meters):`
	`EQS`
	`VLP_tvel:  -929.881165 -115.691681 -576.139221 x y z (m/s)`
	`WQS`
	`VLP_range        1091.579834   (meters)        WQS  (if 0,`
	`then unknown)`
	`VLP_target_id = 300 8 1279  (site, application, entity id)`
	`VLP_target_type = (1,1,222,1,2,2,0)    (" T-72 MBT"," T-72M", )`
	`VLP_threat_type = (2,2,225,2,3,7,0)    ( "" , "" , "" )`
	`VLP_firer_type = (1,1,225,2,1,6,0)    (" FMC M2/M3`
	`Bradley",)`
	`VLP_result = 1    (Entity Impact)`
	`VLP_DetEventID = ( 0 0 81 )`
	`VLP_dataSourceURL =`
	file:/Data/Tables/IUA/dfdam_df1_3V2001.rdr
	the only T72 meta record with the 3V2001.rdr table is:
	`# ##### vehicle_USSR_T72M ##### dfdam_mf_T72M.rdr`
	`#--next line's tgt and threat are:  vehicle_USSR_T72M hit`
	`by a munition_USSR_125HEAT`
	`1 1 222 1 2 2 , 2 2 222 2 18 0 ,"DIS`
	`HitToKill","IUA_HEAT.rdr","file:/Data/Tables/IUA/dfdam_df1_`
	`3V2001.rdr"`		

Resolution Date	Mon Oct 18 15:05:18 EDT 2004		
Resolution Description	Unable to reproduce this error. Never repeated. See PTR 18.		
Notes			

PTR#		18	Title	Re: Found (non-existing) data table !?
Status:	Closed		Date	10/14/04
Severity:	High			
Category:				
Short Description	Followup: (for PTR::HLAmon.RPR_SEIT4::17) This combination still does not have a table but is is NOW being correctly reported as such.			
Further Details				
Resolution Date	Thu Oct 14 13:59:40 EDT 2004 Mon Oct 18 15:05:18 EDT 2004 (re-verified)			
Resolution Description	The problem went away when more data tables were added to the server's meta-table database. Rerun following PTR::HLAmon.RPR_SEIT4::24 (data tables)			
Notes				

PTR#		19	Title	Munition text field mislabeled
Status:	Open		Date	Wed Oct 13 15:24:37 EDT 2004
Severity:	Low			
Category:	Cosmetic – but could be confusing			
Short Description	Text field mislabeled. entity discription is 120mm, but it should be 125mm. Effect: cosmetic. (but could be confusing).			
Further Details	2 2 222 2 18 5704 "Munition" "Anti-Armor" "Commonwealth of Independent States" "Ballistic" " 120mm HEAT-FS" Meta data records are correct: # ##### vehicle_USSR_2S19 ##### dfdam_mf_2S19.rdr #--next line's tgt and threat are: vehicle_USSR_2S19 hit by a munition_USSR_125HEAT 1 1 222 4 26 0 , 2 2 222 2 18 0 ,"DIS HitToKill","IUA_HEAT.rdr","file:/Data/Tables/IUA/dfdam_df1_3V2007.rdr"			
Resolution Date				
Resolution Description				
Notes	This would be fixed in the DIS entity description file: dis2_0_4_ids.csf or dis_entities_aux.csf in the $VLS_HOME/Data/Init/ directory			

PTR#	18a	Title	Missing Data Tables
Status:	Closed	Date	Wed Oct 13 15:05:10 EDT 2004
Severity:	High		
Category:	Data		
Short Description	Missing data table, known target and threat. Wed Oct 13: VLP_target_type = (1,1,225,2,1,6,0) ("FMC M2/M3 Bradley",) VLP_threat_type = (2,2,222,2,2,2,1) ("30SABOT" ,"fromBMP2" , "") Basically need to add the Bradley as target and as shooter (against BMP2 and T72)		

Further Details	Need to add these combinations:
	
	`VLP_target_type = (1,1,222,2,2,1,0)    (" BMP-2"," BMP-2", )`
	`VLP_threat_type = (2,2,225,2,3,7,0) ( ""  , ""  , "" )`
	`munition_US_M792 : DISHighExplosiveIncendiary`
	`VLP_firer_type = (1,1,225,2,1,6,0)    (" FMC M2/M3 Bradley",)`
	
	`VLP_target_type = (1,1,225,2,1,6,0) (" FMC M2/M3 Bradley",)`
	`VLP_threat_type = (2,2,222,2,2,2,1)    ( "30SABOT" , "fromBMP2" , ""   )`
	
	`VLP_target_type = (1,1,225,2,1,6,0)    (" FMC M2/M3 Bradley",)`
	`VLP_threat_type = (2,2,222,2,2,2,1)    ( "30SABOT" , "fromBMP2" , ""   )`
	`VLP_firer_type = (1,1,222,2,2,1,0)    (" BMP-2"," BMP-2", )`
	
	`VLP_target_type = (1,1,225,2,1,6,0)    (" FMC M2/M3 Bradley",)`
	`VLP_threat_type = (2,2,222,2,2,2,1)    ( "30SABOT" , "fromBMP2" , ""   )`
	`VLP_firer_type = (1,1,222,2,2,1,0)    (" BMP-2"," BMP-2", )`		

Resolution Date			10/14/04
Resolution Description	Added a bunch of tables. Also the GAWK scripts: missingPairs.awk missingPairs_2ndPass.awk will scan through stdout (or the file "vlserver_debug2.out") and automatically generate a listing of missing target-threat pairs.		
Notes			

PTR#	20	Title	Text field mislabeled
Status:	Closed	Date	Wed Oct 13 15:50:20 EDT 2004
Severity:	Low		
Category:	Data		
Short Description	entity description for munition_US_M829A2 missing from needed text fields Effect: cosmetic. VLP_threat_type = (2,2,225,2,13,8,0) (""" , """ , """)		
Further Details			
Resolution Date			10/13/04
Resolution Description	Added descriptor for munition_US_M829A2 (plus a few more entities) in the $VLS_HOME/Init/Data/dis_entity_aux.csv file.		
Notes			

PTR#	21	Title	Suspicious data read
Status:	Closed	Date	Wed Oct 13 2004
Severity:	High		
Category:	Network Data Read		
Short Description	50th detonation of a re-run shows an odd VLP_firer_type = (3,0,0,32,61,32,48). This looks like random data and not a true entity type.		
Further Details	50th detonation shows an odd VLP_firer_type = (3,0,0,32,61,32,48) VLP_DetEventID = (0 0 95) ========================= 5 VLP_target_type = (1,1,225,2,1,6,0) (" FMC M2/M3 Bradley",) VLP_threat_type = (2,2,222,2,18,0,0) (" 120mm HEAT-FS",,) VLP_firer_type = (3,0,0,32,61,32,48) (*UNKNOWN* entity enumeration!) This entity firer is a: FiringObjectIdentifier = "300:8:1257gw" This is a T72, "EntityType" (8 bytes). (it is: 0x01 0x01 222 0x01 0x02 0x02 0x00) - That entity was originally created as RTIobject ID = 700247 (according to the vlserver_Creation.log). However it was then removed and recreated repeatedly (maybe timed out on the gateway?).		
Resolution Date			
Resolution Description	This is due to not receiving entity updates after an object has been removed from the federation, then rejoined. But an update has not been obtained for critical data (such as its entity type description). The server was modified to force a request for attribute updates for each newly joined entity. This greatly reduced the occurrence rate of this ptr. However there are still instances when the Gateway simple doesn't respond to the update request or doesn't respond fast enough and there is no entity state information for critical fields (such as "EntityType") when a detonation occurs. An iron-clad solution is to build an internal listing of RTIObject IDs associated with entity identifiers (e.g.: "300:8:1257gw") so that even if "300:8:1257gw" is removed (and then rejoins with a new RTIObject ID, its "state information" i.e. Its attributes will be known even before an update. Two problems with this is that a). it is RPR-FOM specific – it may not work or it might even break with other FOMs. b) It goes against the HLA specification and intent. I.e. When an object is removed, it is removed and deleted. In general one should not		

	assume a newly created entity is supposed to have the same "state information" of a previously deleted entity.
Notes	See PTR 14 Resolutions

PTR#	22	Title	unknown entiy	
Status:	Closed	Date	Wed Oct 13 2004	
Severity:	Low			
Category:	Data configuration			
Short Description	Need to add an entity to dis_entity_aux.csv file			
Further Details	currently the remaining known unknown entities from SEIT DTE-4 are: VLP_threat_type = (2,2,225,2,13,31,3) (*UNKNOWN* entity enumeration!) VLP_threat_type = (2,2,225,2,13,32,2) (*UNKNOWN* entity enumeration!) VLP_threat_type = (2,2,225,2,13,6,0) (*UNKNOWN* entity enumeration!) VLP_threat_type = (2,9,225,2,19,5,0) (*UNKNOWN* entity enumeration!) 2 2 225 2 13 * are "Munition" "Anti-Armor" "United States" "Ballistic" " 120mm" probably KE rounds. 2 9 225 2 19 * is "Munition" "Battlefield Support" "United States" "Ballistic"" 7.62 mm"			
Resolution Date	Thu Oct 14 11:46:06 EDT 2004			
Resolution Description	From OTB 2.0's data tree: (2,2,225,2,13,31,3) US MX943 High Explosive (HE) munition_US_MX943 (2,2,225,2,13,32,2) US MX943 HE shaped charge submunition munition_US_MX943_submun (2,2,225,2,13,6,0) munition_US_M830A1 HEAT (2,9,225,2,19,5,0) munition_US_M240 KE added to dis_entities_aux.csf			
Notes				

PTR#	23	Title	Entity name missing some info
Status:	Close	Date	Thu Oct 14 10:17:07 EDT 2004
Severity:	Low		
Category:	Data configuration - cosmetic		
Short Description	A known entity needed an english description added for cosmetic purposes.		
Further Details	(this has no effect on the proper handling of this munitions damage which was already functioning properly).		
Resolution Date	Thu Oct 14 10:17:07 EDT 2004		
Resolution Description	Added to text name field for dis enumeration (2,2,225,2,3,7,0) munition_US_M792 M792 HE-I (DISHighExplosiveIncendiary)		
Notes	Added text, but not tested yet at time of the fix.		

PTR#	24	Title	Missing data tables (final drop?)
Status:	Closed	Date	Thu Oct 14 13:59:40 EDT 2004
Severity:	Medium		
Category:	Data configuration		
Short Description	Need to add (what might) be the final target-munition parings (vulnerability data tables and meta data records for these tables).		
Further Details	Missing pairs to be added: (1,1,222,1,2,2,0) (2,2,225,2,13,6,0) #--- T72 MBT attacked by a munition_US_M830A1 HEAT (1,1,222,2,2,1,0) (2,2,225,2,13,32,2) #--- BMP-2 attacked by a munition_US_MX943_submun (1,1,222,2,2,1,0) (2,2,225,2,13,6,0) #--- BMP-2 attacked by a munition_US_M830A1 (1,1,222,2,2,1,0) (2,2,225,2,3,7,0) #--- BMP-2 attacked by a M792 HE-I (1,1,222,2,2,1,0) (2,9,225,2,19,5,0) #--- BMP-2 attacked by a munition_US_M240 (1,1,222,4,18,0,0) (2,2,225,2,13,6,0) #--- ZSU-23/4Quad attacked by a munition_US_M830A1 (1,1,222,4,18,0,0) (2,2,225,2,3,7,0) #--- ZSU-23/4Quad attacked by a M792 HE-I (1,1,222,4,18,0,0) (2,9,225,2,19,5,0) #--- ZSU-23/4Quad attacked by a munition_US_M240 (1,1,225,1,1,3,0) (2,2,222,1,10,0,0) #--- M1 Abrams attacked by a AT-8 Songster (1,1,225,1,1,3,0) (2,2,222,1,7,0,0) #--- M1 Abrams attacked by a AT-5 Spandrel (1,1,225,1,1,3,0) (2,2,222,2,11,0,0) #--- M1 Abrams attacked by a 125mm (1,1,225,2,1,4,0) (2,2,222,1,10,0,0) #--- FMC M2/M3 attacked by a AT-8 Songster (1,1,225,2,1,4,0) (2,2,222,1,7,0,0) #--- FMC M2/M3 attacked by a AT-5 Spandrel (1,1,225,2,1,4,0) (2,2,222,2,11,0,0) #--- FMC M2/M3 attacked by a 125mm (1,1,225,2,1,4,0) (2,2,222,2,18,0,0) #--- FMC M2/M3 attacked by a 120mm HEAT-FS (1,1,225,2,1,4,0) (2,2,222,2,2,2,1) #--- FMC M2/M3 attacked by a 30mm SABOT (1,1,225,2,1,6,0) (2,2,222,1,7,0,0) #--- FMC M2/M3 attacked by a AT-5 Spandrel (1,1,225,2,1,6,0) (2,2,222,2,18,0,0) #--- FMC M2/M3 attacked by a 120mm HEAT-FS (1,1,225,2,1,6,0) (2,2,222,2,2,2,1) #--- FMC M2/M3 attacked by a 30mm SABOT (1,1,225,2,30,0,0) (2,2,225,2,13,31,3) #--- M93 Fox attacked by a munition_US_MX943		
Resolution Date	18 October		
Resolution Description	Added the 20 data vl data tables in Meta data table. Source was the unclassified data tree distributed with the OTB 2.0 release (out of the box – as is).		
Notes			

PTR#	25	Title	Missing vl data table
Status:	Closed	Date	Date 18 Oct 2004, 1330
Severity:	Medium		

Category:	Data Configuration
Short Description	Need to add another table.

Further Details	`Add this vl data:`
	`(1,1,222,1,2,2,0) (2,2,225,2,3,7,0) #---  T72 MBT attacked`
	`by a munition_US_M792 HEAT`

Resolution Date	Date 18 Oct 2004
Resolution Description	Added table and meta record.
Notes	

PTR#	26	Title	Table found – but should be an error.
Status:	Opened. *Possible solution - but not implemented yet.*	Date	Mon Oct 18 15:40:27 EDT 2004
Severity:	High		
Category:	Erroneous behavior		
Short Description	LV Server found and processed a table, but it should have not found anything (since the target was not known). The search for a table with that (unknown target) should have failed.		

Further Details	`Reported output for an unknown target. (Target type 0's).`
	`output from 20041018_1130_LVS.Replay:`
	
	`===========AT THIS POINT THE Lethality server would`
	`broadcast=========`
	`------------------------------------------------------------`
	`-------------`
	`DAMAGE RESULT was: 3 (or "PS_MFK_K"`
	`Vulnerability determined SUCCESS - no errors.`
	`Probability distribution: 0.000000 0.000000 0.000000`
	`1.000000 1.000000`
	`------------------------------------------------------------`
	`-------------`
	`#--------------------V/L-Parameters--------START------`
	`#`
	`#-------------dbEntity Coordinate System:  EQS`
	`#-------------World Coordinate System :  WQS`
	`#`
	`#  PARAMTER          VALUE`
	`VLP_ang_aspect    4.533438  (259.746887 degrees)    EQS`
	`VLP_ang_attack    -0.000516  (-0.029590 degrees)    EQS`
	`VLP_impact: -0.324895 0.058426 -1.622985 x y z (meters):`
	`EQS`
	`VLP_tvel:   -243.172913 142.220642 107.388184 x y z (m/s)`
	`WQS`
	`VLP_range         3415.070801   (meters)        WQS  (if`
	`0, then unknown)`
	`VLP_target_id = 0 0 0  (site, application, entity id)`
	`VLP_target_type = (0,0,0,0,0,0,0)   (*UNKNOWN* entity`
	`enumeration!)`
	`VLP_threat_type = (2,2,225,1,1,0,0)   (" BGM-71 TOW",, )`
	`VLP_firer_type = (1,1,225,2,1,4,0)    (" FMC M2/M3`
	`Bradley",)`
	`VLP_result = 1    (Entity Impact)`
	`VLP_DetEventID = ( 0 0 164 )`
	`VLP_dataSourceURL = file:/Data/Tables/IUA/vulnerable.dat`
	`#--------------------V/L-Parameters--------END--------`
	`^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^`

```
^
NO ERROR READING MUNITION DETONATION DATA!
```

Target should be known (300:2:1258gw or -from vlserver_Creation.log: & _updateLog
) 0x01 0x01 222 0x01 0x02 0x02 0x00 (or a T72M), but was removed and then
rejoined (recreated). So it could have no updated entity type field (PTR 14). However,
an error should have been generated when the target-threat combination was not found,
instead some table *was* found and processed.

```
the results should be for a tgt, threat:
 0x01 0x01 222 0x01 0x02 0x02 0x00 , 0x02 0x02 225 0x01
0x01 0x00 0x00
or:
 1 1 222 1 2 2 0 , 2 2 225 1 1 0 0

that is a:
#--next line's tgt and threat are:  vehicle_USSR_T72M hit
by a munition_US_TOW
1 1 222 1 2 2 , 2 2 225 1 1  ,"DIS
HitToKill","IUA_HEAT.rdr","file:/Data/Tables/IUA/dfdam_df1
_3V3015.rdr"

However, vl data was:
VLP_dataSourceURL = file:/Data/Tables/IUA/vulnerable.dat
not file:/Data/Tables/IUA/dfdam_df1_3V3015.rdr

note, the stdout reports:
   tgt: (0,0,0,0,0,0,0)
 firer: (1,1,225,2,1,4,0)

It also happened in:  361 "Gateway"
==========AT THIS POINT THE Lethality server would
broadcast==========
-----------------------------------------------------------
-------------
DAMAGE RESULT was: 3 (or "PS_MFK_K"
Vulnerability determined SUCCESS - no errors.
Probability distribution: 0.000000 0.000000 0.000000
1.000000 1.000000
-----------------------------------------------------------
-------------
#--------------------V/L-Parameters--------START------
#
#-------------dbEntity Coordinate System:  EQS
#------------World Coordinate System :  WQS
#
#   PARAMTER          VALUE
VLP_ang_aspect    6.093836  (349.151062 degrees)    EQS
VLP_ang_attack    -0.030817  (-1.765667 degrees)    EQS
VLP_impact: 0.132881 0.686893 -1.013761 x y z (meters):
EQS
VLP_tvel:   -292.672913 53.718353 -48.465462 x y z (m/s)
WQS
VLP_range         3043.112305    (meters)        WQS  (if
0, then unknown)
VLP_target_id = 0 0 0  (site, application, entity id)
VLP_target_type = (0,0,0,0,0,0,0)    (*UNKNOWN* entity
enumeration!)
VLP_threat_type = (2,2,225,1,1,0,0)    (" BGM-71 TOW",, )
VLP_firer_type = (1,1,225,2,1,6,0)    (" FMC M2/M3
Bradley",)
VLP_result = 1    (Entity Impact)
VLP_DetEventID = ( 0 0 361 )
VLP_dataSourceURL = file:/Data/Tables/IUA/vulnerable.dat
#--------------------V/L-Parameters--------END--------
```

Resolution Date			10/25/04
Resolution Description	Possible likely resolution: Internal queries for tables use 0 (or NULL) as wild cards. Therefore querying a target type of: "VLP_target_type = (0,0,0,0,0,0,0)" should match some target. Need to trace (step trough code) and examine query algorithm with this isolated detonation.		
Notes	Possibly related to PTR 17		

PTR#	27	Title	Table lookup error (.rdr KE format)
Status:	Closed	Date	3 November 2004 - (date entered, resolved earlier)
Severity:	High		
Category:	Coding error		
Short Description	1) Low-level ".rdr" file parser set to wrong target exposure. 2) Error in parsing IUA (in .rdr format) hull defilade target vulnerability.		
Further Details	There is a coding error in the .rdr parser that results in returning the wrong data on partially exposed targets discovered in the server DTE-4 verification. See Appendix **LOOKUP_VERIFICATION.**		
Resolution Date	Date Tue Sep 28 16:09:58 EDT 2004		

Resolution Description	The wrong "target" exposure code was being passed to the lookup function. The proper code to be passed should be a "1" - indicating a fully exposed target since the server has no terrain data to mask targets and therefore all target are assumed to be fully exposed when hit.
	
	`I recompile glue.c with a 1 or 2:`
	`    50 /* showing: turret AND hull or turret-only exposure`
	`read in next, 1 and 2 respectively */`
	`    51 return rdr_ground (table, 1 /* 1= fully showing */`
	`, angle, VLP_range,`
	`    52                    dispersion * METERS_TO_void *`
	
	While this address the PTR (and avoids any errors returned in the data), eventually the hull defilade target exposure lookup bug needs to be fixed. Therefore this PTR is closed, but a new PTR (28) is generated to address the hull defilade lookup.		

Notes	Erik Greenwald (author of the parser) helped to confirm that there is a bug in the parser.		

PTR#		28	Title	Table lookup error (.rdr KE format)
Status:	Open		Date	Wed Nov 3 10:00:34 EST 2004
Severity:	Low			
Category:	Coding error			
Short Description	Error in parsing IUA (in .rdr format) hull defilade target vulnerability.			
Further Details	There is a coding error in the .rdr parser that results in returning the wrong data on partially exposed targets (KE .rdr file formats).			
Resolution Date				
Resolution Description				
Notes	This PTR has no impact until terrain is added to the servers and used to mask targets in a defensive (hull protected) position.			

PTR#		29	Title	Verify Entity Count
Status:	Open		Date	11 November 2004
Severity:	Low			
Category:	Status check			
Short Description	Applications (OTB, MaK Gateway) are observed to classify entities differently from the server. If entity count and tracking is not consistent across the distributed environment, at least those differences should be understood and accounted for in the pre-exercise check list.			
Further Details	A master pre-exercise check list should be compiled and used.			
Resolution Date				
Resolution Description				
Notes				

PTR#		30	Title	Verify Entity Crucial Attributes
Status:	Open		Date	30 November 2004
Severity:	Medium			
Category:	Status check			
Short Description	On a rare occasion, when stressed and under other conditions (when federates repeatedly resign and rejoin the federation) the server may have an incomplete entity state record. The result is the server cannot complete a table lookup because an important item (for example the type of target) is missing from an entities attribute fields.			
Further Details	The server likely missed the best effort update for the entity in question. *A software module should be added to "inventory critical attributes" on all entities and report on entities that are missing attributes that are important to the table lookup and automatically issue a "request for entity attribute update" to those entities. To reduce overhead this module is only and exercised during key scenario points, such as if gateways are recycled, scenario start, or at the operator's digression.*			
Resolution Date				
Resolution Description				
Notes				

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Appendix B. Example of a Detailed Lethality Data "Look-up" Verification

The server successfully processed the result from the 53rd observed detonation. Data from this event were examined in the detail as a validation of the server's operation when it knew what the target and threat were and had a vulnerability table that described the outcomes for this threat-target pairing.

The actual raw data observed from the HLA environment were published in the Munition Detonation interaction record and are shown in table B-1.

Table B-1. Uninterrupted MunitionDetonation (53rd) record (see appendix F).

Field	Value
EventIdentifier	103 "Gateway"
DetonationResultCode	0x01
DetonationLocation	-1526355.384922, -5186988.049459, 3374174.746967
FiringObjectIdentifier	"300:8:1353gw
FinalVelocityVector	-154.676208, -668.172302, -1074.823730
"FuseType"	0
MunitionObjectIdentifier	""
MunitionType	0x02 0x02 225 0x02 0x0d 0x08 0x00
QuantityFired	1
RateOfFire	0
RelativeDetonationLocation	0.339180 -0.009386 -1.937987
TargetObjectIdentifier	"300:8:1344gw"
WarheadType	5000

As part of its function, the server monitors entity state updates and therefore knows the type of target and shooter involved in this exchange (represented by the "TargetObjectIdentifier" and "FiringObjectIdentifier" fields in table B-1).   Entity (target and firer object) updates along with data from the MunitionDetonation record and associated WeaponFire record (if known) are used in combination to *interpret* these raw data into variables that make sense when one is conducting a vulnerability calculation table lookup. Figure B-1 displays the server's interpretation of these data translated to coordinates that it uses internally (see appendix H for these variable descriptions). This output was captured during this DTE-4 run off the server's console.

```
==========AT THIS POINT THE Lethality server would
broadcast==========
-----------------------------------------------------------------------
-
DAMAGE RESULT was: 4 (or "NO_DAMAGE"
Vulnerability determined SUCCESS - no errors.
Probability distribution: 0.000000 0.100000 0.300000 0.700000 1.000000
-----------------------------------------------------------------------
-
#--------------------V/L-Parameters--------START------
#
#------------dbEntity Coordinate System:  EQS
#------------World Coordinate System :  WQS
#
#  PARAMTER          VALUE
VLP_ang_aspect     4.681568  (268.234070 degrees)     EQS
VLP_ang_attack     0.001620  (0.092828 degrees)      EQS
VLP_impact: 0.339180 -0.009386 -1.937987 x y z (meters):
EQS
VLP_tvel:   -154.676208 -668.172302 -1074.823730 x y z (m/s)
WQS
VLP_range           2323.999023   (meters)         WQS  (if 0, then
unknown)
VLP_target_id = 300 8 1344  (site, application, entity id)
VLP_target_type = (1,1,222,1,2,2,0)     (" T-72  MBT T-72M", )
VLP_threat_type = (2,2,225,2,13,8,0)     ( "" , "" , ""  )
VLP_firer_type = (1,1,225,1,1,3,0)     (" M1 Abrams"," M1A2", )
VLP_result = 1     (Entity Impact)
VLP_DetEventID = ( 0 0 6 )
#--------------------V/L-Parameters--------END--------
```

Figure B-1. V/L validation parameters (output) with traceability.

The vulnerability meta data record shows this to be

#-- tgt and threat are: vehicle_USSR_T72M hit by a munition_US_M829A2
1 1 222 1 2 2 , 2 2 225 2 13 8 ,"DIS HitToKill","IUA_KE.rdr","file:/Data/Tables/IUA/dfdam_df1_2V1001.rdr"

Therefore, the unclassified vulnerability data table "dfdam_df1_2V1001.rdr" is identified to describe damage for this munition against this target. This reader file is 1,262 lines in length, a portion of which is displayed in figure B-2.

We manually step through this data file based on all the significant initial conditions.
The first examined is "VLP_result = 1   (Entity Impact)".   Had the result been a miss, ground impact other non-"entity Impact" we could have stopped at that point and ruled the result "No Damage". This is because the threat is a KE round fired against a hard (tank) target and it must impact the target in order to cause any significant damage.

```
;; $Revision$ ^M
;; File "dfdam1_2V1001.rdr" generated from:
"/a1/A2ATD/unclass/Vulnerability_Data/./Blue_Shooter/2v1001.unc"^M
;; by the program "dfdam2rdr" at Mon May  1 11:51:46 1995^M
;;^M
;; Macro for this file is "2V1001"^M
;;^M
;; Contains ranges:  0 500 1000 1500 2000 2500 3000 3500 4000^M
;;^M
;; Comments from input file:^M
;; first read in is the weapon ^M
;; then the range is read in, in the form listed above^M
;; hull or turret exposure read in next, 1 and 2 respectively^M
;; dispersions range from 1 to 10 and include the damage at
different^M
;; angles in degrees for M_KILL, F_KILL, MF_KILL, and K_KILL
respectively^M
;; the degrees go read as 0, 30, 60, 90. 120, 150 from left to
right^M
;;^M
;;^M
(IUA^M
(0 ^M
  ( ^M
    ( ^M
      ( 0.600 0.600 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
      ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
      ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
      ( 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.000 ) ^M
    ) ^M
    ( ^M
      ( 0.600 0.600 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
      ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
```

Figure B-2. Beginning of IUA file (in .rdr format)

The next parameter examined is the range shown as:

```
VLP_range          2323.999023   (meters)
```

This places the shot in the 2000- to 2500-meter range bracket of the vulnerability file, bringing us line 571 of "dfdam_df1_2V1001.rdr" (figure B-3).

The next variable in the table is target exposure (fully exposed being the first parenthesis bracket or if the target only has its turret exposed, we would skip to the next bracket that starts a line 640). Since all targets are assumed to be fully exposed, we stay in this exposure bracket at line 572. (Note that since we have an impact point of the round on the target, we could determine if the round struck the hull or turret, provided that we also had the geometric dimensions for the target.) A more sophisticated lethality server might, but this current table lookup server contains no target geometries.

```
567          ( 0.300 0.300 0.300 0.300 0.300 0.300 0.300 0.000 ) ^M
568        )^M
569      )^M
570    )  ^M
571    (2000 ^M
572      (  ^M
573        (  ^M
574          ( 0.600 0.600 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
575          ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
576          ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
577          ( 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.000 ) ^M
578        )  ^M
579        (  ^M
580          ( 0.600 0.600 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
581          ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
582          ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
583          ( 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.000 ) ^M
584        )  ^M
585        (  ^M
586          ( 0.600 0.600 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
587          ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
588          ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
589          ( 0.400 0.400 0.400 0.400 0.400 0.400 0.400 0.000 ) ^M
590        )  ^M
```

Figure B-3. Case study: IUA data range bracket achieved.

The next parameter is how far from the center of a fully exposed target the round struck in feet
(dispersions range brackets from 1 to 10 feet). From figure B-1, we see the impact point is

```
VLP_impact: 0.339180 -0.009386 -1.937987 x y z (meters):      EQS
```

This is the x,y,z position of the round impact from the origin (center of the) target. Taking the
root sum square of this impact point and converting from meters to feet produces 6.45 feet
(falling in the 6- to 7-foot dispersion bracket that begins on line 609). These dispersions are
displayed in figure B-4. Also shown in figure B-4 are words that mark the start of each
dispersion bracket. As with the displayed line numbers, these words do not appear in the original
vulnerability data files; they are overlaid in the figure for clarity. Additionally, the ^M
characters seen indicate a line-feed control character (which actually *is* in the data file) but it has
no effect on the table reader and may be invisible, depending on the text editor and operating
system used when one is viewing these data files.

```
603      ( ^M            <<====== 5 to 6 ft dispersion here
604        ( 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.000 ) ^M
605        ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
606        ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
607        ( 0.300 0.300 0.400 0.400 0.400 0.400 0.400 0.000 ) ^M
608      ) ^M
609      ( ^M            <<====== 6 to 7 ft dispersion here
610        ( 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.000 ) ^M
611        ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
612        ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
613        ( 0.300 0.300 0.400 0.400 0.400 0.400 0.400 0.000 ) ^M
614      ) ^M
615      ( ^M            <<====== 7 to 8 ft dispersion here
616        ( 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.000 ) ^M
617        ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
618        ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
619        ( 0.300 0.300 0.400 0.400 0.400 0.400 0.400 0.000 ) ^M
620      ) ^M
```

Figure B-4. Case study: IUA data round dispersion bracket achieved.

The final significant factor is the angular aspect of the incoming round with respect to the target which is shown to be 4.7 radians or 268 degrees as displayed in figure B-1 with the text:

```
VLP_ang_aspect     4.681568   (268.234070 degrees)      EQS
```

The columns in the 6- to 7-foot dispersion bracket (lines 609 to 614 in figure B-4) contain the aspect angle read as 0, 30, 60, 90. 120, 150 degrees from left to right. The target is assumed to be symmetric (meaning that an impact between 0 and 30 degrees is equivalent to an impact from 330 to 360 degrees). Thus, as can be visualized in figure B-5, 268 degrees falls in a 240- to 270- bracket (equivalent to the 90- to 120-degree bracket).
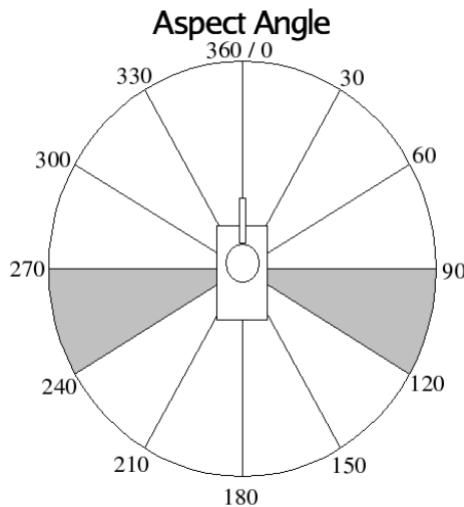
Figure B-5. Aspect angle symmetry.

As figure B-6 displays (with overlaid text printing the aspect angles), the 240- to 270-degree bracket (*and equivalent 90-120 ^{0}*) is the fourth column in the lines 610 to 613.

```
   609          (              ;;<<===== 6 to 7 ft dispersion here    ^M

;;                  0-    30-    60-    90-    120-   150-   AVG    N/A
;;                  330-   300-   270-   240-   210-   AVG    N/A
   610          ( 0.600 0.600 0.600 0.600 0.600 0.600 0.600 0.000 ) ^M
   611          ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
   612          ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
   613          ( 0.300 0.300 0.400 0.400 0.400 0.400 0.400 0.000 ) ^M
   614          ) ^M
```

Figure B-6. Case study: IUA munition aspect angle (the relative angle by which the munition approaches the target).

The values in this column (.6, .7, .7, .4) represent the loss of *any type* of mobility, firepower, the union of mobility or firepower, and catastrophic damage. Most combat simulations are not interested in these data. They are usually interested in whether the target is mobility killed *only* (M_KILL), or firepower killed *only* (F_KILL), or both M_KILL and F_KILL'd, or complete catastrophically killed (K_KILL), or if there was no damage at all. This requires converting the "*any type of*" damage to "*only* one *type of*" damage statistic by the applying following equations *(Equations B-1):*

monly   = kill[INDEX_MFKILL] - kill[INDEX_FKILL];
fonly   = kill[INDEX_MFKILL] - kill[INDEX_MKILL];
fandm   = kill[INDEX_FKILL]   - kill[INDEX_KKILL] – fonly;
and k only is rmains kill[INDEX_KKILL]

Equations B-1

(where kill[INDEX_MKILL], kill[INDEX_FKILL], kill[INDEX_MFKILL], and kill[INDEX_KKILL] are the "*any type of*" damage data found in the 4th column of the vulnerability table). i.e.:

kill[INDEX_MKILL]   = .6
kill[INDEX_FKILL]   = .7
kill[INDEX_ MFKILL]   = .7
kill[INDEX_KKILL]   = .4

Equations B-2

Substituting the values of equations B-2 into B-1 results in:

```
monly        =     .7 - .7      =     .0
fonly        =     .7 - .6      =     .1
fandm        =     .7 - .4 – fonly =  .2
konly        =     .4           =     .4
no damage=1. - (monly+fonly+mandf+konly) =  .3
```

Equations B-3

For the convenience of drawing randomly from this distribution of outcomes we accumulate the loss of functions sequentially (add them together)

```
M_KILL_SPACE      =        0        + monly      = .0        = 0.0
F_KILL_SPAC E     = M_KILL_SPACE   + fonly      = .0 + .1   = 0.1
MF_KILL_SPACE     = F_KILL_SPAC E  + fandm      = .1 + .2   = 0.3
KKILL_SPACE       = MF_KILL_SPACE  + konly      = .3 + .4   = 0.7
NO_DAMAGE_SPACE = KKILL_SPACE    + no damage   = .7 + .3   = 1.0
```

Equations B-4.

As a final validation, we compare our event distribution vector resulting from equations B-4 (0.0, 0.1, 0.3, 0.7, 1.0) to the result that was observed in the server's record run output shown in figure B-1 (labeled "probability distribution" and reprinted in figure B-7:

```
===========AT THIS POINT THE Lethality server would
broadcast=========
---------------------------------------------------------------------
-
DAMAGE RESULT was: 4 (or "NO_DAMAGE"
Vulnerability determined SUCCESS - no errors.
Probability distribution: 0.000000 0.100000 0.300000 0.700000 1.000000
---------------------------------------------------------------------
-
```

Figure B-7. Case study: returned lethality data results apparently correct.

Also seen in figure B-7 is a "DAMAGE RESULT" shown to be "NO_DAMAGE." This means that the server randomly drew from the distribution wherein the likelihood of *no damage* was .3 (30%).

Preliminary conclusion:

We see that the when the server had the correct vulnerability source file (as in this case), it returned apparently the correct answer.   We shall shortly prove the answer is ***actually wrong.*** It is obvious from figure B-4 that the data for 5-, 6-, and 7-foot dispersions are the same.   Therefore, it is possible that the correct answer was coincidentally retrieved from the *wrong* place in the look-up table.   The source data file was modified as displayed in figure B-8.   This was done

to verify that we are actually retrieving data from the correct region (6- to 7-foot dispersion bracket data) as opposed to some other region. The look-up portion of the server was then re-run off line, being stimulated with the same significant input matching those from this detonation test case (namely, range and dispersion). Other parameters were not significant or implied (such as result, target, and threat type) and the aspect angle was set to zero.

```
607      ( ;;   5-6 foot dispersion ^M
608  ;;        0-   30-   60-   90-  120-  150-   AVG   N/A    ^M
609  ;;      360-  330-  300-  270-  240-  210-   AVG   N/A    ^M
610         ( 0.500 0.600 0.600 0.600 0.600 0.600 0.600 0.000 ) ^M
611         ( 0.500 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
612         ( 0.500 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
613         ( 0.500 0.300 0.400 0.400 0.400 0.400 0.400 0.000 ) ^M
614      ) ^M
615      ( ;;   6-7 foot dispersion ^M
616  ;;        0-   30-   60-   90-  120-  150-   AVG   N/A    ^M
617  ;;      360-  330-  300-  270-  240-  210-   AVG   N/A    ^M
618         ( 0.600 0.500 0.600 0.600 0.600 0.600 0.600 0.000 ) ^M
619         ( 0.600 0.600 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
620         ( 0.600 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
621         ( 0.600 0.900 0.400 0.400 0.400 0.400 0.400 0.000 ) ^M
622      ) ^M
623      ( ;;   7-8 foot dispersion ^M
624  ;;        0-   30-   60-   90-  120-  150-   AVG   N/A    ^M
625  ;;            330-  300-  270-  240-  210-   AVG   N/A    ^M
626         ( 0.700 0.500 0.600 0.600 0.600 0.600 0.600 0.000 ) ^M
627         ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
628         ( 0.700 0.700 0.700 0.700 0.700 0.700 0.700 0.000 ) ^M
629         ( 0.700 0.300 0.400 0.400 0.400 0.400 0.400 0.000 ) ^M
630      ) ^M
```

Figure B-8. Modified IUA data (from figure B-4).

Setting the aspect angle to zero would force a lookup in the "zero and less than 30 degree" set of aspect columns displayed in bold within figure B-8. The results of this off-line test are abbreviated in figure B-9. The aspect angle column retrieved is displayed in bold in figure B-9 and marked with the label "**heh.**" This test showed that in fact the 6.454943 foot dispersion data were being incorrectly accessed and instead taken from in the 7- to 8-foot dispersion bracket (lines 626 to 629 in figure B-8).

This error motivated a detailed reexamination of the .rdr lookup source code. This uncovered coding error in the way the target exposure field was selected. All targets were being treated as hull defilade and not fully exposed. Correcting this coding error had two positive effects: 1) We finally produced the correct lookup in our case (i.e., rows 618 to 621 in figure B-8 were correctly accessed when dispersion was between 6 and 7 feet); 2) we discovered that the "hull defilade" look-up algorithm was erroneous for .rdr files (and should not be used until it is fixed). This should not be a problem for the time being as the current server assumes that all targets are fully exposed.

50

```
LOOKUP TABLE USED: /home/geoffs/TEST_dfdam_df1_2V1001.rdr
#--------------------V/L-Parameters--------START------
#
#------------dbEntity Coordinate System:  EQS
#------------World Coordinate System :  WQS
#
#  PARAMTER          VALUE
VLP_ang_aspect    0.000000  (0.000000 degrees)     EQS
VLP_ang_attack    0.000000  (0.000000 degrees)     EQS
VLP_impact: 0.339180 -0.009386 -1.937987 x y z (meters):          EQS
VLP_tvel:   0.000000 0.000000 0.000000 x y z (m/s)            WQS
VLP_range         2323.999023   (meters)     WQS  (if 0, then unknown)
VLP_target_id = 0 0 0  (site, application, entity id)
VLP_target_type = (0,0,0,0,0,0,0)    (*UNKNOWN* entity enumeration!)
VLP_threat_type = (0,0,0,0,0,0,0)    (*UNKNOWN* entity enumeration!)
VLP_firer_type = (0,0,0,0,0,0,0)    (*UNKNOWN* entity enumeration!)
VLP_result = 0    (Other)
VLP_DetEventID = ( 0 0 0 )
#--------------------V/L-Parameters--------END--------

table            val              range           showing dispersion      angle
0x08180410       0xBFFFEB30       2323.999000     2       6.454943        0.000000
angle: 0


heh 0.700000 0.700000 0.700000 0.700000
0.000000 0.000000 0.000000 0.700000 1.000000
```

Figure B-9. Results of off-line rdr file lookup testing.

Final Conclusion

An error was discovered the .rdr table look-up algorithm. We uncovered the error by applying a
detailed algorithm "walk through" and exercising the look-up component "off line" through all
parameter ranges *(a thorough verification procedure)*. This error incorrectly applied "terrain"
masked survivability to "fully" exposed targets and was fixed in PTR 27. An error remains in
how data are looked up for the terrain-masked case. Because the server does not use terrain, this
is not an issue. However, a new PTR was created (PTR 28) to track this error and to ensure that
it is addressed at the time that terrain features are considered.

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Appendix C. Vulnerability Server Internal Parameters

The internal lethality server maintains a data dictionary to represent the initial conditions for vulnerability calculations (or table lookup). The parameters in this dictionary lie between the external environment and the table look-up algorithms as displayed in figure C-1. By insulating parameters in this manner, the server may connect to any number of synthetic environments (or HLA FOMs). The synthetic environment representation is translated to server internal parameters (VL Param) units, allowing the vulnerability algorithms or table look-up algorithms to access the VL Parameters.
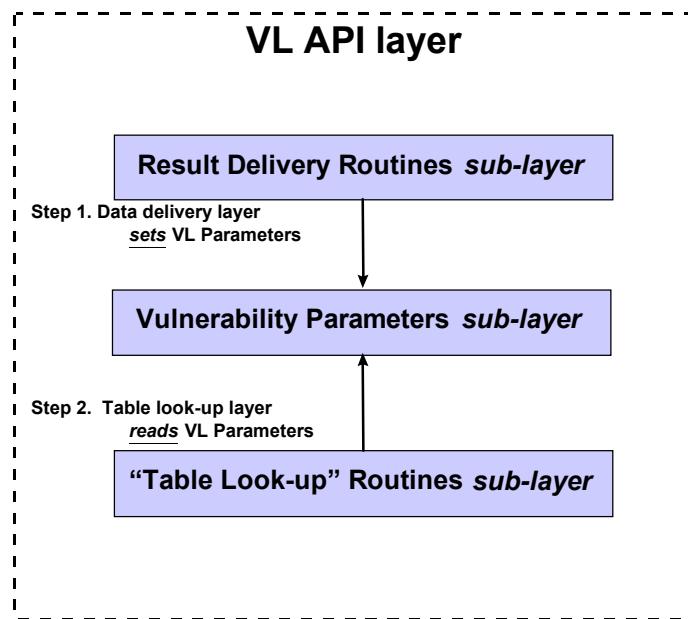
Figure C-1. VL parameter layer (lethality server internal parameters).

Figure C-2 displays a sample output from the server displaying the current value for certain VL parameters.

The rest of this appendix describes the parameters in the VL Param layer.

```
#--------------------V/L-Parameters--------START------
#
#------------dbEntity Coordinate System:  EQS
#------------World Coordinate System :  WQS
#
#  PARAMTER          VALUE
VLP_ang_aspect     6.115278  (350.379608 degrees)     EQS
VLP_ang_attack     0.002300  (0.131770 degrees)      EQS
VLP_impact: -0.043465 -0.261724 -1.748757 x y z (meters):
EQS
VLP_tvel:    -292.482697 49.471294 -53.837307 x y z (m/s)
WQS
VLP_range           2396.261719   (meters)          WQS  (if 0, then
unknown)
VLP_target_id = 300 8 1240  (site, application, entity id)
VLP_target_type = (1,1,222,1,2,2,0)    (" T-72  MBT T-72M", )
VLP_threat_type = (2,2,225,1,1,0,0)    (" BGM-71 TOW",, )
VLP_firer_type = (1,1,225,2,1,6,0)    (" FMC M2/M3 Bradley",)
VLP_result = 1     (Entity Impact)
VLP_DetEventID = ( 0 0 6 )
#--------------------V/L-Parameters--------END--------
```

Figure C-2. Server VL Param output display.

```
notes: "target" refers to the queried entity who's resulting vulnerablity is
       being asked for of the server.

       EntityID - is the DIS Entity ID record (site, application, entity).
             IEEE 1278.1

       float32 - 32bit floating point number.
       float64 - 64bit floating point number.
       enum    - a unitless enumerated value.
```

```
      Entity Coordinate system:

          ^ -Z          (Entity's coordinate system used in IEEE 1278.1
          |                     Note that "up" is -Z
          |
          |
          |'top'
          |
          |
        ../_/|.. entity
        / |_| ======    'front'
        |    | |  -------------->
        |__/___|/               X
         /  |
        /   |
       /    |
      /     |
     /      v
    /      +Z
   /
  /
 |/
   Y
```
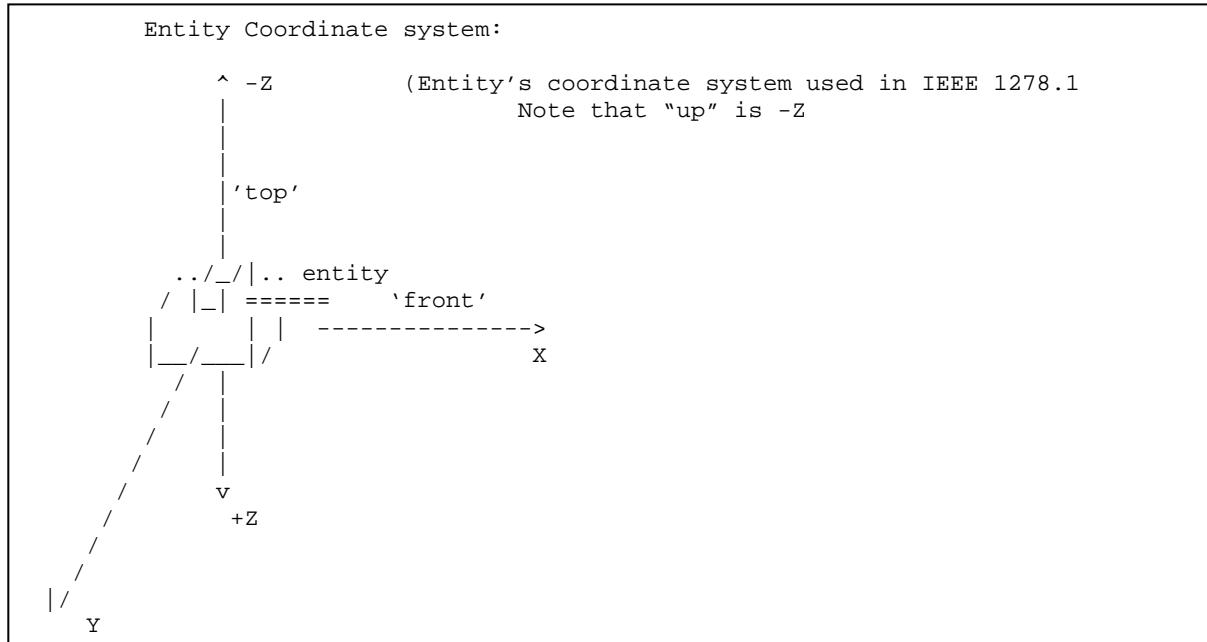
Figure C-3. DIS (IEEE 1278.1) entity coordinate system (ES).

```
PARAMETER        TYPE    UNITS            MEANING
---------        ----    -----    ------------------------------------

VLP_ang_aspect float32 radians  'horizontal' orientation of munition's
                                 directional attack (aspect angle)
                                 (relative to the target entity).
                                 (Rotation is about the target entity's
                                 positive "z" axis in a clockwise
                                 direction).  The positive direction of
                                 rotation about an axis is defined as
                                 clockwise when viewed towards the
                                 positive direction along the axis of
                                 rotation.

                                 Clockwise direction: For example, a 90
                                 degree (PI/2 radian) clockwise rotation
                                 about the z axis will make the positive
                                 x-axis co-linear to where the positive
                                 y-axis was before the rotation.

                                 Targetted entity's coordinate system is
                                 that of IEEE 1278.1 with the positive
                                 X-Axis axis extending from the "front"
                                 of the entity.  Positive Z-Axis
                                 extending "down".  Positive Y-Axis
                                 extending out of the entity's "right".


                                 See Also: VLP_ang_attck.


VLP_ang_attck float32  radians  "Angle of attack".  'vertical' orientation
                                 of munition's directional attack (aspect
                                 angle) (relative to the target).
                                 (Rotation is about the target entity's
                                 new "X" axis after having been rotated
                                 by the angle VLP_ang_aspect.

                                 See Also: VLP_ang_aspect.


VLP_impact[3] float32  meters   Location of munition impact point
                                 relative to the target.  Location is in
                                 target entity's coordinate system. (IEEE
                                 1278.1)


VLP_tvel[3]   float32   m/s     Terminal velocity of the munition
                                 immediately before impact.  This is in
                                 the DIS world coordinate system linear
                                 velocity vector record 1278.1 Units
                                 are in meters per second.
                                 (Same as the "velocity" field of the
                                  DIS Detonation PDU).

VLP_range     float64  meters   (line of sight) range from the target to
                                 the origin of the munition. (i.e.
                                 distance from where the munition was
                                 fired to where it detonated).

                                 The DIS Standard states that the "range"
                                 field in the Fire PDU is set to 0 if the
```

```
                       range is unknown.  If this is the case,
                       then the VL server shall attempt to
                       guess at the approximate range by
                       setting the VLP_range to the distance
                       between the target and firing entity (if
                       known).  If this approximation fails for
                       some reason, then VLP_Range shall remain
                       set to 0.

VLP_result   int   enum    result of the detonation (if known)
                       the enumeration are according to the
                       DIS standard (IEEE 1278.1)

                       Note: for a kinetic energy munitions
                       (That is type VL_Meth = "DIS HitToKill"
                       in the DAMAGE_SOURCE_META_DATA_FILE).
                       only:
                            1    Entity Impact
                            2    Entity Proximate Detonation
                            5    Detonation

                       will currently have an effect on
                       the targetted entity.

                         Value    Description
                            0    Other
                            1    Entity Impact
                            2    Entity Proximate Detonation
                            3    Ground Impact
                            4    Ground Proximate Detonation
                            5    Detonation
                            6    None
                            7    HE hit, small
                            8    HE hit, medium
                            9    HE hit, large
                           10    Armor-piercing hit
                           11    Dirt blast, small
                           12    Dirt blast, medium
                           13    Dirt blast, large
                           14    Water blast, small
                           15    Water blast, medium
                           16    Water blast, large
                           17    Air hit
                           18    Building hit, small
                           19    Building hit, medium
                           20    Building hit, large
                           21    Mine-clearing line charge
                           22    Environment object impact
                           23    Environment object proximate detonation
                           24    Water Impact
                           25    Air Burst


VLP_target_id EntityID    Targeted Entity's ID. (site, host, id)
                       If there was an entity impact
                       indicated by the= VLP_result field,
                       then this is the entity which was
                       impacted.

VLP_target_type EntityType    Type of entity Targeted. (Entity Enumeration)
                       If there was an entity impact
                       indicated by the= VLP_result field,
                       then this is the type of entity which
```

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was impacted (e.g. "T72M1", "M48").

VLP_target_terrain_environment Unint32 Used to describe terrain area of target
for application in terrain masking lethal
effects of the threat.

VLP_fuse_type Unint32   Type of fuze enumeration. Usually fuze
is implied within the DIS 7-field enumeration
(the EntityType). However ModSAF data
structures segments the fuze as a separate field.

VLP_threat_id EntityID   Threat Entity's ID. (site, host, id)
If the treating object (impacting or
detonating object) is an entity,
then this is its Entity's ID. (site, host, id)
(Normally the threat is not an entity,
but an inanimate munition, in which case
the VLP_threat_id

VLP_threat_type EntityType   Type of threating object. (Entity Enumeration)
(Normally the threat is a munition
in which case this field will be derived
from the DIS Burst descriptor field of
the detonation and fire PDUs).

VLP_firer_id EntityID   If the originating entity (the shooter)
can be determined, then this is its
entity ID.

VLP_firer_type EntityType   If the originating entity (the shooter)
can be determined, then this field
identifies the DIS entity type.

VLP_DetEventID EventID   The EventID field found in firePDUs and
Detonation PDUs. (used to ascociated
the two events). [has three subfields of unsigned int16].
 typedef struct {
        Unint16   address.site;
        Unint16   address.application;
        Unint16 event_id;
 } EventID;

VLP_dataSourceURL   The filename or URL containing the vulnerabilty data
used in the analysis.

The vulnerability table reader fucntions must derive all of it's
required environmental information from these data structures.
If it requires additional environmental data, then the
lethatlity server code will have to be modified to provide that
data.

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Appendix D. Incomplete Input: One Explanation

A case examination of equivalent detonations between two (log file playback) runs.

The point illustrated in this appendix is that 1) the server correctly received all the munition detonation-related data that were (reliably) sent to it but 2) occasionally, those data were incomplete, resulting in an incomplete vulnerability calculation (through no fault of the server). In this case, having incomplete data could have been avoided by not translating from DIS to HLA.

As stated in the validation procedures, each of the more than 400 MunitionDetonations was examined to determine that the server received and processed the input correctly. This case is selected to demonstrate how missing a critical piece of information (such as identifying the target entity) makes it impossible to determine a damage outcome. When this happens, the best the server can do is to flag the error (as it already does), namely, that it was not properly provided with required data. The solution must then be resolved from among the other participating simulation components and system architecture (configuration).

We derived this example by comparing a particular detonation event between two of the log file re-runs executed 19 October 2004 at 1045 a.m. and at 1232 p.m. that same day. In the first run (that we refer to as 20041019_1045), this particular detonation contained no target identifier yet in the second re-run (20041019_1232), the same detonation event *did* contain the target identifier. In this detailed examination (in addition to the normal server standard output), the server's own log file of all captured HLA data was examined in order to know what data were received from the network ("on the wire").

In reviewing the normal standard output for both runs (shown in figures D-1 and D-2), we saw that the server reported "NO ERRORS READING" (which means that all the expected data fields of the MunitionDetonations in question arrived). Yet in the first re-play, TargetObject Identifier is seen as an empty string ("").

Because of the "NO ERRORS READING..." message, we have confidence that the report seen on the standard output shows exactly the data that **were** in fact received for the TargetObject Identifier field, but we further confirm this by examining the detailed HLA log files that were generated by the server. Excerpts of these log files are displayed in figures D-3 and D-4.

Extracted from 20041019_1045.script:

```
in: _updateFromMiddlewareMunitionDetonation():
v v v v v v v v v v v v v v v v v v v v v v v v v v v v v v v v v
SOM_Interaction {
  RTI::ObjectClassHandle  rti_handle = 30
  InteractionClassName = InteractionRoot.MunitionDetonation
  locallyControlled = true
  InteractionsReceived = 42
  InteractionsSent = 0
  vector <DataElement *>  parameters= {
    DetonationLocation = -1531249.812218 -5187689.896913 3370937.994619
(WorldLocationStruct)
    DetonationResultCode = 0x01 (DetonationResultCodeEnum8)
    EventIdentifier = 79 "Gateway"  (EventIdentifierStruct)
    FiringObjectIdentifier = "300:8:1223gw"  (RTIObjectIdStruct)
    FinalVelocityVector = -929.881165 -115.691681 -576.139221 (VelocityVectorStruct)
    FuseType = 0 (FuseTypeEnum16)
    MunitionObjectIdentifier = ""  (RTIObjectIdStruct)
    MunitionType = 0x02 0x02 225 0x02 0x03 0x07 0x00 (EntityTypeStruct)
    QuantityFired = 1 (unsigned short)
    RateOfFire = 0 (unsigned short)
    RelativeDetonationLocation = 1.153606 0.794216 -2.014180 (RelativePositionStruct)
    TargetObjectIdentifier = ""  (RTIObjectIdStruct)
    WarheadType = 1200 (WarheadTypeEnum16)
  } // end vector <DataElement *>  parameters
} // end of SOM_Interaction

^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^
NO ERROR READING MUNITION DETONATION DATA!
```

Figure D-1. Sever detonation standard output report (run 1).

Extracted from 20041019_1232.script:

```
 in: _updateFromMiddlewareMunitionDetonation():
v v v v v v v v v v v v v v v v v v v v v v v v v v v v v v v
SOM_Interaction {
   RTI::ObjectClassHandle  rti_handle = 30
   InteractionClassName = InteractionRoot.MunitionDetonation
   locallyControlled = true
   InteractionsReceived = 43
   InteractionsSent = 0
   vector <DataElement *>  parameters= {
      DetonationLocation = -1531249.812218 -5187689.896913 3370937.994619
(WorldLocationStruct)
      DetonationResultCode = 0x01 (DetonationResultCodeEnum8)
      EventIdentifier = 80 "Gateway"  (EventIdentifierStruct)
      FiringObjectIdentifier = "300:8:1223gw"  (RTIObjectIdStruct)
      FinalVelocityVector = -929.881165 -115.691681 -576.139221 (VelocityVectorStruct)
      FuseType = 0 (FuseTypeEnum16)
      MunitionObjectIdentifier = ""  (RTIObjectIdStruct)
      MunitionType = 0x02 0x02 225 0x02 0x03 0x07 0x00 (EntityTypeStruct)
      QuantityFired = 1 (unsigned short)
      RateOfFire = 0 (unsigned short)
      RelativeDetonationLocation = 1.153606 0.794216 -2.014180 (RelativePositionStruct)
      TargetObjectIdentifier = "300:8:1279gw"  (RTIObjectIdStruct)
      WarheadType = 1200 (WarheadTypeEnum16)
   } // end vector <DataElement *>  parameters
} // end of SOM_Interaction

^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^
NO ERROR READING MUNITION DETONATION DATA!
```

Figure D-2. Sever detonation standard output report (run 2).

The HLA log files revealed that, in the first run, only a null (a single byte with the value of zero) was received for the target identifier field whereas in the latter run, the bytes 0x3330303a383a31323739677700 arrived. These incoming data are highlighted in figures D-3 and D-4.

Extracted from 20041019_1045 HLA log file:

```
### receiveInteraction. RTI::InteractionClassHandle is: 30 callback Tag is:ef36b3cc
### (---- interaction is: InteractionRoot.MunitionDetonation )---- ###
### incomming data 0[a/an: UNDEFINED ] (len= 0) bytes are: 0x
void rtiFC_FederateAmbassador::receiveInteraction( RTI::InteractionClassHandle ,const
RTI::ParameterHandleValuePairSet& ,const char* theTag):Unkown interaction paramter (handle0) rti_link.cc:2673
### incomming data 1[a/an: DetonationLocation ] (len= 24) bytes are:
0xc1375d71cfed7e3ac153ca1a796706504149b7dcff4faee0
After set it is 24 bytes: 0x96b8100 see: 0x3a7eedcf715d37c1500667791aca53c1e0ae4fffdcb74941
### incomming data 2[a/an: DetonationResultCode ] (len= 1) bytes are: 0x01
After set it is 1 bytes: 0x96b8130 see: 0x01
### incomming data 3[a/an: EventIdentifier ] (len= 10) bytes are: 0x004f4761746577617900
After set it is 10 bytes: 0x96b8160 see: 0x4f004761746577617900
### incomming data 4[a/an: FiringObjectIdentifier ] (len= 13) bytes are: 0x3330303a383a31323233677700
After set it is 13 bytes: 0x96b8188 see: 0x3330303a383a31323233677700
### incomming data 5[a/an: FinalVelocityVector ] (len= 12) bytes are: 0xc4687865c2e76224c41008e9
After set it is 12 bytes: 0x96b81d0 see: 0x657868c42462e7c2e90810c4
### incomming data 6[a/an: FuseType ] (len= 2) bytes are: 0x0000
After set it is 2 bytes: 0x96b81f0 see: 0x0000
### incomming data 7[a/an: MunitionObjectIdentifier ] (len= 1) bytes are: 0x00
After set it is 1 bytes: 0x96b8210 see: 0x00
### incomming data 8[a/an: MunitionType ] (len= 8) bytes are: 0x020200e102030700
After set it is 8 bytes: 0x96b8290 see: 0x0202e10002030700
### incomming data 9[a/an: QuantityFired ] (len= 2) bytes are: 0x0001
After set it is 2 bytes: 0x96b82b0 see: 0x0100
### incomming data 10[a/an: RateOfFire ] (len= 2) bytes are: 0x0000
After set it is 2 bytes: 0x96b82d0 see: 0x0000
### incomming data 11[a/an: RelativeDetonationLocation ] (len= 12) bytes are: 0x3f93a9603f4b51c4c000e852
After set it is 12 bytes: 0x96b8310 see: 0x60a9933fc4514b3f52e800c0
### incomming data 12[a/an: TargetObjectIdentifier ] (len= 1) bytes are: 0x00
After set it is 1 bytes: 0x96b8338 see: 0x00
### incomming data 13[a/an: WarheadType ] (len= 2) bytes are: 0x04b0
After set it is 2 bytes: 0x96b8360 see: 0xb004
----------filled-in interaction-----vvvv
SOM_Interaction {
  RTI::ObjectClassHandle  rti_handle = 30
  InteractionClassName = InteractionRoot.MunitionDetonation
  locallyControlled = true
  InteractionsReceived = 42
  InteractionsSent = 0
  vector <DataElement *>  parameters= {
    DetonationLocation = -1531249.812218 -5187689.896913 3370937.994619 (WorldLocationStruct)
    DetonationResultCode = 0x01 (DetonationResultCodeEnum8)
    EventIdentifier = 79 "Gateway"  (EventIdentifierStruct)
    FiringObjectIdentifier = "300:8:1223gw"  (RTIObjectIdStruct)
    FinalVelocityVector = -929.881165 -115.691681 -576.139221 (VelocityVectorStruct)
    FuseType = 0 (FuseTypeEnum16)
    MunitionObjectIdentifier = ""  (RTIObjectIdStruct)
    MunitionType = 0x02 0x02 225 0x02 0x03 0x07 0x00 (EntityTypeStruct)
    QuantityFired = 1 (unsigned short)
    RateOfFire = 0 (unsigned short)
    RelativeDetonationLocation = 1.153606 0.794216 -2.014180 (RelativePositionStruct)
    TargetObjectIdentifier = ""  (RTIObjectIdStruct)
    WarheadType = 1200 (WarheadTypeEnum16)
  } // end vector <DataElement *>  parameters
} // end of SOM_Interaction


---------------------------------^^^^
```

Figure D-3. Sever detonation received HLA data (run 1).

Extracted from 20041019_1232 HLA log:

```
### receiveInteraction. RTI::InteractionClassHandle is: 30 callback Tag is:d6a22e78
### (---- interaction is: InteractionRoot.MunitionDetonation )---- ###
### incomming data 0[a/an: UNDEFINED ] (len= 0) bytes are: 0x
void rtiFC_FederateAmbassador::receiveInteraction( RTI::InteractionClassHandle ,const
RTI::ParameterHandleValuePairSet& ,const
 char* theTag):Unkown interaction paramter (handle0) rti_link.cc:2673
### incomming data 1[a/an: DetonationLocation ] (len= 24) bytes are:
0xc1375d71cfed7e3ac153ca1a796706504149b7dcff4faee0
After set it is 24 bytes: 0x988a1a8 see: 0x3a7eedcf715d37c1500667791aca53c1e0ae4fffdcb74941
### incomming data 2[a/an: DetonationResultCode ] (len= 1) bytes are: 0x01
After set it is 1 bytes: 0x988a1d8 see: 0x01
### incomming data 3[a/an: EventIdentifier ] (len= 10) bytes are: 0x00504761746577617900
After set it is 10 bytes: 0x988a208 see: 0x50004761746577617900
### incomming data 4[a/an: FiringObjectIdentifier ] (len= 13) bytes are: 0x3330303a383a31323233677700
After set it is 13 bytes: 0x988a218 see: 0x3330303a383a31323233677700
### incomming data 5[a/an: FinalVelocityVector ] (len= 12) bytes are: 0xc4687865c2e76224c41008e9
After set it is 12 bytes: 0x988a260 see: 0x657868c42462e7c2e90810c4
### incomming data 6[a/an: FuseType ] (len= 2) bytes are: 0x0000
After set it is 2 bytes: 0x988a280 see: 0x0000
### incomming data 7[a/an: MunitionObjectIdentifier ] (len= 1) bytes are: 0x00
After set it is 1 bytes: 0x988a2a0 see: 0x00
### incomming data 8[a/an: MunitionType ] (len= 8) bytes are: 0x020200e102030700
After set it is 8 bytes: 0x988a320 see: 0x0202e10002030700
### incomming data 9[a/an: QuantityFired ] (len= 2) bytes are: 0x0001
After set it is 2 bytes: 0x988a340 see: 0x0100
### incomming data 10[a/an: RateOfFire ] (len= 2) bytes are: 0x0000
After set it is 2 bytes: 0x988a360 see: 0x0000
### incomming data 11[a/an: RelativeDetonationLocation ] (len= 12) bytes are: 0x3f93a9603f4b51c4c000e852
After set it is 12 bytes: 0x988a3a0 see: 0x60a9933fc4514b3f52e800c0
### incomming data 12[a/an: TargetObjectIdentifier ] (len= 13) bytes are: 0x3330303a383a31323739677700
After set it is 13 bytes: 0x988a3c8 see: 0x3330303a383a31323739677700
### incomming data 13[a/an: WarheadType ] (len= 2) bytes are: 0x04b0
After set it is 2 bytes: 0x988a3f0 see: 0xb004
----------filled-in interaction-----vvvv
SOM_Interaction {
  RTI::ObjectClassHandle  rti_handle = 30
  InteractionClassName = InteractionRoot.MunitionDetonation
  locallyControlled = true
  InteractionsReceived = 43
  InteractionsSent = 0
  vector <DataElement *>  parameters= {
    DetonationLocation = -1531249.812218 -5187689.896913 3370937.994619 (WorldLocationStruct)
    DetonationResultCode = 0x01 (DetonationResultCodeEnum8)
    EventIdentifier = 80 "Gateway"  (EventIdentifierStruct)
    FiringObjectIdentifier = "300:8:1223gw"  (RTIObjectIdStruct)
    FinalVelocityVector = -929.881165 -115.691681 -576.139221 (VelocityVectorStruct)
    FuseType = 0 (FuseTypeEnum16)
    MunitionObjectIdentifier = ""  (RTIObjectIdStruct)
    MunitionType = 0x02 0x02 225 0x02 0x03 0x07 0x00 (EntityTypeStruct)
    QuantityFired = 1 (unsigned short)
    RateOfFire = 0 (unsigned short)
    RelativeDetonationLocation = 1.153606 0.794216 -2.014180 (RelativePositionStruct)
    TargetObjectIdentifier = "300:8:1279gw"  (RTIObjectIdStruct)
    WarheadType = 1200 (WarheadTypeEnum16)
  } // end vector <DataElement *>  parameters
} // end of SOM_Interaction

--------------------------------^^^^
```

Figure D-4. Sever detonation received HLA data (run 2).

We now have the utmost confidence that the gateway did not send the target's identification (based on data observed in figure D-3). On the other hand, we are equally confident that the server did in fact see all the data (that were sent to it). This is because, by their very nature, interactions parameters are sent "all at once" (packed within in a single set of parameter-value pairs and distributed by the HLA RTI). In addition, the configuration files were modified to insist that these detonation data were sent reliably.

In summary, when incomplete data arrive, the best the server can do is to flag the error (as it already does). Following this, the root cause for the missing data must be determined and corrected. In this example, the root cause is likely related to the gateway having missed some of the (best effort UDP transmission) DIS data packets and therefore being unable to make a complete HLA translation. To avoid this in the future, we recommend

- Native HLA should be logged (this would have avoided missed DIS PDUs), particularly if updates were sent reliably.
- The original federation should be configured to transmit all weapon fire and detonation data reliably.

Appendix E. Entity Updates (relative number of occurrences)

The relative number of updates observed by the server during the approximate 82-minute recorded log file are recorded in table E-1. These are "relative" in that they do not reflect the actual number of updates because updates are sent "best effort" but they fall within 1% to 2% of the actual number of updates.[12]

Table E-1. Top 20 entities in terms of absolute updates observed.

Updates	RTI Object ID	Entity Description
59508	100003	ATC Stryker 5 (VDMS) 400:1:5
20212	106957	ATTC generated entity 500:5:1(rejoined)
10850	111995	WSMR generated entity 200:3:6
7978	114301	ATTC generated entity 500:5:1(rejoined)
5111	112069	Remote test center generated entity 600:3:1gw
3829	100948	WSMR generated entity 200:3:6
2706	100949	WSMR generated entity 200:3:5
2582	100010	ATC live entity 400:1:4
2161	100945	WSMR generated entity 200:3:2
1820	100946	WSMR generated entity 200:3:3
1807	100119	ATTC generated entity 500:5:1
1760	118308	RTTC (OTB?) entity 300:2:1325
1757	118222	RTTC (OTB?) entity 300:8:1330
1751	100951	WSMR generated entity 200:3:1
1746	117289	RTTC (OTB?) entity 300:8:1328
1737	116439	RTTC (OTB?) entity 300:2:1343
1736	116309	RTTC (OTB?) entity 300:2:1339
1711	118050	RTTC (OTB?) entity 300:2:1360
1697	117156	RTTC (OTB?) entity 300:2:1336
1686	116151	RTTC (OTB?) entity 300:2:1335

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[12]The actual number of updates is not important because each record run ran for a different amount of time with a varying number of updates for each run. Also, updates were sent in a best effort mode; therefore, a certain number will be missed, depending on processor speed and whether the server has active debugging or data-logging features (as reported in this report and specifically in PTR 6). Furthermore, these data may have been collected with the logger playing back the exercise in "loop-mode" repeating a portion of the log file (and updates). That said, these data were confirmed to be very close to the actual number of updates when these statistics were recalculated with loop-play turned off and the playback run at 1/4 speed (taking about 5.5 hours to run) to reduce the likelihood of missing updates. The results were within 1% to 2% of the statistics shown.

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Appendix F. MunitionDetonation Records

This appendix is a compilation of all (DIS PDU translated) HLA munition detonation interaction events that were recorded and observed by the server during log file replays. These provided the input stimulus for most of the server's evaluation. The MunitionDetonation Record is defined as part of the RPR FOM, table 7-5 "MunitionDetonation Parameters," (reference , pp. 79) which is the authoritative reference and includes more technical details (such as data types, etc) than table F-1. Table F-1 is provided here as a convenience explaining the fields paraphrased in the author's words. Table F-2 provides the MunitionDetonation records. The only field in table F-2 that is not part of the RPR FOM is the first column (*index*). The "index" column is simply the ordinal number for the munition detonation record shown (in the order seen during the simulation exercise).

Table F-1. MuntionDetonation fields.

Field	Explanation
ArticulationParameters	*Identifies entity articulated components (e.g. landing gear) affected by the detonation. Not used by the server as incorporated vulnerability tables would not account for individual articulated parts.*
EventIdentifier	Unique identifies the MunitionDetonation interaction event. Used to associate the detonation with a WeaponFire interaction
DetonationResultCode	A DIS compatible enumeration to indicate the detonation results (such as a ground impact, entity impact, air burst, etc.).
DetonationLocation	Identifies (in DIS compatible world coordinates) where the munition detonated
FiringObjectIdentifier	Identifies the firing entity. Entity identifiers are persistent, consistent and unique across the federation execution
FinalVelocityVector	Provide the direction and velocity of the munition at the instant of detonation.
FuseType	A DIS standard compliant enumeration that identifies the munition's fuze type.
MunitionObjectIdentifier	At times the munition itself is treated as an entity (this is practiced for many guided missiles). Another example could be a kamikaze attack. Thus the munition itself is an entity and will have an entity identifier.
MunitionType	The DIS compliant enumeration (a seven-tuple) identifying the type of munition (the threat)
QuantityFired	The number of munitions involved in this detonation. Some weapons employ burst fire methods (machine guns for example). In a distributed environment it is more efficient to communicate the burst rather than flooding the environment individual weapon fire and detonation interactions for each bullet.
RateOfFire	Rounds per minute (used for burst fire methods). If this value is 0, the field may be ignored.
RelativeDetonationLocation	Where on the entity or in relation to the entity's local origin the detonation occurred. This is relative to the entity and in the DIS compatible entity coordinate system.
TargetObjectIdentifier	The entity identifier for the target. If this data is not provided, the server cannot determine damage to the target.
WarheadType	The DIS compliant enumeration identifying the warhead type

Table F-2. MunitionDetonation events log record (part 1).

index	EventIdentifier	Detonation Result Code	Detonation Location	Firing Object Identifier	Final Velocity Vector
1	" 1 "Gateway" "	" 0x01 "	" -1531236.210672 -5187662.227535 3370985.947092 "	" "300:8:1223gw" "	" -292.482697 49.471294 -53.837307 "
2	" 2 "Gateway" "	" 0x03 "	" -1527837.020777 -5188212.930600 3371653.995299 "	" "" "	" 1236.847168 -208.314896 228.995544 "
3	" 5 "Gateway" "	" 0x03 "	" -1532553.737672 -5187403.340404 3370782.008215 "	" "300:8:1216gw" "	" -293.000519 57.890354 -41.126778 "
4	" 6 "Gateway" "	" 0x03 "	" -1527840.307612 -5188273.412975 3371559.176716 "	" "300:8:1237gw" "	" 655.538208 -145.512726 68.707474 "
5	" 8 "Gateway" "	" 0x03 "	" -1527836.842940 -5188214.250862 3371651.978908 "	" "300:8:1240gw" "	" 1236.847168 -208.314896 228.995544 "
6	" 9 "Gateway" "	" 0x03 "	" -1532550.236021 -5187403.769928 3370782.934086 "	" "300:8:1216gw" "	" -293.000519 57.890354 -41.126778 "
7	" 11 "Gateway" "	" 0x03 "	" -1527836.891595 -5188213.903153 3371652.509052 "	" "300:8:1240gw" "	" 1236.846802 -208.311295 229.000778 "
8	" 12 "Gateway" "	" 0x01 "	" -1531236.113070 -5187662.615902 3370985.329899 "	" "300:8:1216gw" "	" -293.000519 57.890354 -41.126778 "
9	" 14 "Gateway" "	" 0x03 "	" -1527847.552933 -5188363.755960 3371417.708601 "	" "300:8:1237gw" "	" 1234.840820 -307.853973 77.583015 "
10	" 16 "Gateway" "	" 0x03 "	" -1527847.801440 -5188365.658423 3371414.835513 "	" "300:8:1237gw" "	" 1234.861938 -307.664917 77.995003 "
11	" 17 "Gateway" "	" 0x01 "	" -1531247.370841 -5187539.391800 3371163.923151 "	" "300:8:1221gw" "	" -292.982178 59.249527 -39.280312 "
12	" 18 "Gateway" "	" 0x03 "	" -1527839.998216 -5188207.723461 3371660.665541 "	" "300:8:1237gw" "	" 1239.049194 -250.571823 166.120132 "
13	" 21 "Gateway" "	" 0x03 "	" -1531916.162672 -5187534.904962 3370864.905576 "	" "300:8:1223gw" "	" -1066.037964 168.969879 -212.160645 "
14	" 23 "Gateway" "	" 0x03 "	" -1531918.536720 -5187535.269825 3370863.117859 "	" "300:8:1223gw" "	" -1066.015747 168.697159 -212.489288 "
15	" 24 "Gateway" "	" 0x03 "	" -1528182.480822 -5185917.761510 3374987.075093 "	" "300:8:1335gw" "	" 133.319275 -108.281876 -106.501602 "
16	" 26 "Gateway" "	" 0x03 "	" -1531923.496447 -5187533.603366 3370863.404924 "	" "300:8:1223gw" "	" -1065.966553 168.192200 -213.135651 "
17	" 27 "Gateway" "	" 0x03 "	" -1529408.410453 -5184818.327614 3376124.669482 "	" "300:8:1230gw" "	" -662.641418 607.079041 634.319641 "
18	" 29 "Gateway" "	" 0x03 "	" -1529514.262391 -5184720.546092 3376228.345547 "	" "300:8:1230gw" "	" -656.598450 608.610962 639.117493 "
19	" 30 "Gateway" "	" 0x03 "	" -1531931.054569 -5187534.798784 3370858.165680 "	" "300:8:1223gw" "	" -1065.878906 167.377502 -214.212341 "
20	" 32 "Gateway" "	" 0x01 "	" -1531233.391104 -5187627.648599 3371039.314514 "	" "300:8:1221gw" "	" -292.377808 48.203251 -55.530781 "
21	" 38 "Gateway" "	" 0x03 "	" -1531763.410761 -5187544.468331 3370920.939364 "	" "300:8:1221gw" "	" -1065.389160 165.848434 -217.807770 "
22	" 40 "Gateway" "	" 0x03 "	" -1529525.937948 -5185069.696018 3375690.613713 "	" "300:8:1225gw" "	" -843.490784 539.888000 455.021088 "
23	" 42 "Gateway" "	" 0x03 "	" -1531890.918626 -5187529.863236 3370885.458273 "	" "300:8:1221gw" "	" -1063.910034 155.843094 -231.966354 "
24	" 43 "Gateway" "	" 0x03 "	" -1532048.561639 -5187525.598636 3370819.201665 "	" "300:8:1223gw" "	" -1064.298828 154.083282 -231.357635 "
25	" 47 "Gateway" "	" 0x03 "	" -1529411.020894 -5185122.881995 3375657.493491 "	" "300:8:1225gw" "	" -773.382751 571.872253 533.705200 "
26	" 50 "Gateway" "	" 0x03 "	" -1532084.528402 -5187514.680729 3370819.725841 "	" "300:8:1221gw" "	" -1060.902832 136.344009 -256.701111 "
27	" 52 "Gateway" "	" 0x03 "	" -1528480.318747 -5185875.770526 3374918.291356 "	" "300:8:1243gw" "	" 536.009949 -565.618469 -626.712891 "
28	" 53 "Gateway" "	" 0x03 "	" -1532219.312573 -5187521.981647 3370751.405968 "	" "300:8:1223gw" "	" -1059.926025 133.094299 -262.379059 "
29	" 54 "Gateway" "	" 0x03 "	" -1528529.401873 -5185920.206537 3374830.094561 "	" "300:8:1334gw" "	" 444.503723 -577.357483 -684.890381 "
30	" 56 "Gateway" "	" 0x03 "	" -1528523.996946 -5185923.943862 3374826.978926 "	" "300:8:1243gw" "	" 476.209320 -574.660339 -665.575073 "
31	" 60 "Gateway" "	" 0x03 "	" -1532199.608215 -5187514.509849 3370771.313581 "	" "300:8:1221gw" "	" -1057.719971 123.958633 -275.431732 "
32	" 61 "Gateway" "	" 0x03 "	" -1528629.993600 -5185890.934440 3374829.723170 "	" "300:8:1335gw" "	" 375.933777 -581.513184 -721.468079 "
33	" 62 "Gateway" "	" 0x03 "	" -1532217.789672 -5187515.948964 3370761.306663 "	" "300:8:1221gw" "	" -1057.114868 121.801476 -278.697906 "
34	" 65 "Gateway" "	" 0x01 "	" -1528778.107237 -5185724.894031 3375020.058171 "	" "300:8:1335gw" "	" 348.167542 -582.241943 -734.692871 "
35	" 66 "Gateway" "	" 0x01 "	" -1528778.685250 -5185723.823202 3375019.504733 "	" "300:8:1334gw" "	" 359.629669 -581.978943 -729.360718 "
36	" 68 "Gateway" "	" 0x01 "	" -1528784.223459 -5185722.668991 3375019.084692 "	" "300:8:1335gw" "	" 337.146912 -582.600403 -739.532776 "
37	" 72 "Gateway" "	" 0x03 "	" -1532041.081835 -5187648.283665 3370638.374021 "	" "300:8:1223gw" "	" -1033.686157 51.451191 -372.619995 "
38	" 73 "Gateway" "	" 0x01 "	" -1531233.771764 -5187628.621029 3371039.713664 "	" "300:8:1221gw" "	" -1030.433472 43.611832 -382.498260 "

39	" 74 "Gateway" "	" 0x03 "	" -1532673.139191 -5187582.518594 3370449.960819 "	" "300:8:1221gw" "	" -1024.345825 29.376251 -399.815643 "
40	" 76 "Gateway" "	" 0x01 "	" -1531233.258337 -5187628.821010 3371038.420092 "	" "300:8:1221gw" "	" -1019.506592 18.413509 -412.634491 "
41	" 77 "Gateway" "	" 0x03 "	" -1532708.980300 -5187817.913576 3370068.362609 "	" "300:8:1223gw" "	" -951.870789 -87.818214 -544.270081 "
42	" 80 "Gateway" "	" 0x01 "	" -1531249.812218 -5187689.896913 3370937.994619 "	" "300:8:1223gw" "	" -929.881165 -115.691681 -576.139221 "
43	" 82 "Gateway" "	" 0x03 "	" -1531166.070720 -5187469.648277 3371304.852385 "	" "300:8:1280gw" "	" 154.964111 330.254456 567.928772 "
44	" 86 "Gateway" "	" 0x01 "	" -1531233.506633 -5187644.937296 3371011.598884 "	" "300:8:1223gw" "	" -240.463562 -542.760559 -926.060608 "
45	" 87 "Gateway" "	" 0x01 "	" -1531233.169659 -5187645.321692 3371011.628340 "	" "300:8:1216gw" "	" -117.275627 -129.991531 -245.439667 "
46	" 88 "Gateway" "	" 0x01 "	" -1531295.277815 -5187772.232767 3370788.557916 "	" "300:8:1221gw" "	" -341.753387 -507.435425 -914.173889 "
47	" 89 "Gateway" "	" 0x01 "	" -1531296.426620 -5187773.260615 3370789.531323 "	" "300:8:1221gw" "	" -335.806519 -509.567444 -915.191223 "
48	" 91 "Gateway" "	" 0x01 "	" -1531147.637036 -5187331.020062 3371529.758100 "	" "300:8:1280gw" "	" 126.877884 339.507111 569.440002 "
49	" 93 "Gateway" "	" 0x01 "	" -1531248.942889 -5187687.876341 3370937.852798 "	" "300:8:1295gw" "	" 150.096634 332.080109 568.171448 "
50	" 94 "Gateway" "	" 0x01 "	" -1531187.190238 -5187312.304082 3371539.951869 "	" "300:8:1257gw" "	" 67.797485 357.179108 568.728027 "
51	" 98 "Gateway" "	" 0x03 "	" -1523518.239253 -5185023.446523 3378401.390387 "	" "300:8:1326gw" "	" 434.081207 193.987381 479.131927 "
52	" 99 "Gateway" "	" 0x05 "	" -1510477.474707 -5173913.732874 3401078.198137 "	" "700:1:702gw" "	" 0.000000 0.000000 0.000000 "
53	" 103 "Gateway" "	" 0x01 "	" -1526355.384922 -5186988.049459 3374174.746967 "	" "300:8:1353gw" "	" -154.676208 -668.172302 -1074.823730 "
54	" 105 "Gateway" "	" 0x03 "	" -1528964.292006 -5188205.387014 3371168.879566 "	" "300:8:1257gw" "	" 652.707214 -169.436523 29.825054 "
55	" 108 "Gateway" "	" 0x03 "	" -1532539.007389 -5187192.803150 3371108.596115 "	" "300:8:1341gw" "	" -285.398590 95.176033 19.523663 "
56	" 109 "Gateway" "	" 0x01 "	" -1531233.276549 -5187628.485673 3371038.316284 "	" "300:8:1308gw" "	" -288.715179 30.364340 -81.323708 "
57	" 110 "Gateway" "	" 0x03 "	" -1532542.915978 -5187191.361514 3371109.034549 "	" "300:8:1341gw" "	" -285.379150 95.218102 19.602423 "
58	" 114 "Gateway" "	" 0x01 "	" -1531290.585913 -5181919.961258 3379772.864382 "	" "300:8:1232gw" "	" -315.668549 -503.206757 -925.816589 "
59	" 115 "Gateway" "	" 0x01 "	" -1531266.805153 -5187733.985865 3370863.630831 "	" "300:8:1308gw" "	" -283.557220 15.768348 -101.186264 "
60	" 116 "Gateway" "	" 0x01 "	" -1531019.270744 -5181641.794523 3380336.785352 "	" "300:8:1282gw" "	" 421.399628 396.317200 815.692993 "
61	" 118 "Gateway" "	" 0x01 "	" -1531180.477135 -5181713.672753 3380147.463849 "	" "300:8:1305gw" "	" 283.641815 445.825867 848.991516 "
62	" 119 "Gateway" "	" 0x03 "	" -1529555.469255 -5188084.746081 3371069.390858 "	" "300:8:1280gw" "	" 656.841919 -120.774086 97.965836 "
63	" 120 "Gateway" "	" 0x01 "	" -1531193.562330 -5181711.000120 3380145.665355 "	" "300:8:1305gw" "	" 206.883957 473.242401 856.294739 "
64	" 121 "Gateway" "	" 0x01 "	" -1531208.834189 -5181707.380203 3380143.630960 "	" "300:8:1305gw" "	" 131.679367 496.156281 858.189636 "
65	" 123 "Gateway" "	" 0x01 "	" -1531242.531714 -5181729.240935 3380094.619738 "	" "300:8:1232gw" "	" 151.456161 -600.629150 -909.013550 "
66	" 125 "Gateway" "	" 0x01 "	" -1531303.965352 -5181689.845853 3380133.491582 "	" "300:8:1305gw" "	" -387.634399 555.128235 735.915894 "
67	" 128 "Gateway" "	" 0x01 "	" -1531377.390014 -5181676.855827 3380126.380685 "	" "300:8:1305gw" "	" -652.932678 506.919373 562.771423 "
68	" 131 "Gateway" "	" 0x01 "	" -1531377.438861 -5181676.720091 3380126.199720 "	" "300:8:1305gw" "	" -652.932678 506.919373 562.771423 "
69	" 134 "Gateway" "	" 0x01 "	" -1531377.432752 -5181676.606341 3380125.987581 "	" "300:8:1235gw" "	" -555.867737 290.005890 250.065231 "
70	" 136 "Gateway" "	" 0x03 "	" -1529475.257471 -5185014.121149 3375797.460074 "	" "300:8:1353gw" "	" -1233.228271 317.981934 -60.501709 "
71	" 141 "Gateway" "	" 0x01 "	" -1531528.220713 -5181551.488386 3380284.261677 "	" "300:8:1303gw" "	" -190.983322 550.453064 812.728027 "
72	" 142 "Gateway" "	" 0x03 "	" -1529471.332391 -5185014.940481 3375797.726549 "	" "300:8:1353gw" "	" -652.690369 169.330475 -30.780615 "
73	" 143 "Gateway" "	" 0x03 "	" -1531444.366649 -5181878.958013 3379771.754096 "	" "300:8:1377gw" "	" -290.674225 79.999886 0.711125 "
74	" 144 "Gateway" "	" 0x01 "	" -1531528.325204 -5181551.245164 3380284.070421 "	" "300:8:1303gw" "	" -190.983322 550.453064 812.728027 "
75	" 146 "Gateway" "	" 0x01 "	" -1531527.684300 -5181551.559182 3380284.443900 "	" "300:8:1303gw" "	" -190.983322 550.453064 812.728027 "
76	" 150 "Gateway" "	" 0x01 "	" -1531703.991179 -5181560.619232 3380169.417520 "	" "300:8:1255gw" "	" -480.014862 559.204468 675.926086 "
77	" 151 "Gateway" "	" 0x01 "	" -1531528.381023 -5181550.696001 3380283.683634 "	" "300:8:1303gw" "	" -190.983322 550.453064 812.728027 "
78	" 155 "Gateway" "	" 0x03 "	" -1529467.057980 -5185014.456095 3375800.139258 "	" "300:8:1353gw" "	" -652.377319 171.255188 -26.466475 "
79	" 156 "Gateway" "	" 0x01 "	" -1531701.829853 -5181560.623482 3380171.145128 "	" "300:8:1255gw" "	" -481.702087 559.025146 674.873352 "
80	" 158 "Gateway" "	" 0x03 "	" -1529144.570031 -5185096.782729 3375816.518689 "	" "300:8:1283gw" "	" -800.079224 248.134613 23.375616 "
81	" 159 "Gateway" "	" 0x03 "	" -1529150.949707 -5184904.970488 3376106.273153 "	" "300:8:1254gw" "	" -810.011536 211.765045 -35.788746 "

82	" 160 "Gateway" "	" 0x03 "	" -1529144.570031 -5185096.782729 3375816.518689 "	" "300:8:1283gw" "	" -799.849670 248.788101 24.269478 "
83	" 161 "Gateway" "	" 0x03 "	" -1529144.570031 -5185096.782729 3375816.518689 "	" "300:8:1283gw" "	" -799.807312 248.909210 24.422276 "
84	" 162 "Gateway" "	" 0x03 "	" -1506157.391981 -5177872.671250 3397027.488043 "	" "300:2:1359gw" "	" -243.172913 142.220642 107.388184 "
85	" 165 "Gateway" "	" 0x03 "	" -1529150.949707 -5184904.970488 3376106.273153 "	" "300:8:1254gw" "	" -809.500061 214.374542 -31.577904 "
86	" 167 "Gateway" "	" 0x01 "	" -1505885.460959 -5178033.345988 3396914.013214 "	" "300:2:1359gw" "	" -243.172913 142.220642 107.388184 "
87	" 169 "Gateway" "	" 0x03 "	" -1526925.982879 -5185722.163411 3375851.043258 "	" "300:8:1266gw" "	" 1185.897705 -443.122406 -151.373947 "
88	" 170 "Gateway" "	" 0x03 "	" -1529413.920531 -5185063.484040 3375747.789681 "	" "300:8:1326gw" "	" -1239.014648 243.273041 -176.877884 "
89	" 173 "Gateway" "	" 0x03 "	" -1531431.789505 -5181902.560438 3379740.885421 "	" "300:8:1377gw" "	" -291.097870 78.425148 -1.876632 "
90	" 174 "Gateway" "	" 0x03 "	" -1530561.747016 -5183030.025346 3378342.218542 "	" "300:8:1233gw" "	" 524.016846 -620.115479 -742.201538 "
91	" 177 "Gateway" "	" 0x01 "	" -1529149.899659 -5185115.322618 3375788.797170 "	" "300:8:1345gw" "	" -639.216187 212.930588 41.088493 "
92	" 179 "Gateway" "	" 0x03 "	" -1529131.395080 -5185068.096772 3375866.211487 "	" "300:8:1321gw" "	" -808.518433 219.211487 -22.096216 "
93	" 181 "Gateway" "	" 0x03 "	" -1527981.286923 -5187992.981143 3371916.237759 "	" "300:8:1280gw" "	" 1207.871338 -89.548798 398.312378 "
94	" 182 "Gateway" "	" 0x03 "	" -1527137.267540 -5185662.857484 3375845.942843 "	" "300:8:1266gw" "	" 1180.486572 -451.791962 -167.214096 "
95	" 189 "Gateway" "	" 0x03 "	" -1531278.738247 -5182184.759210 3379362.834955 "	" "300:8:1233gw" "	" 613.211060 -603.021423 -685.811462 "
96	" 190 "Gateway" "	" 0x03 "	" -1529131.395080 -5185068.096772 3375866.211487 "	" "300:8:1321gw" "	" -808.227295 220.490799 -19.911695 "
97	" 192 "Gateway" "	" 0x01 "	" -1529151.504424 -5184907.821605 3376106.165043 "	" "300:8:1247gw" "	" -656.180664 133.267838 -85.390976 "
98	" 193 "Gateway" "	" 0x03 "	" -1506145.495230 -5177879.376639 3397022.673333 "	" "300:2:1359gw" "	" -243.172913 142.220642 107.388184 "
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108	" 216 "Gateway" "	" 0x03 "	" -1531229.821915 -5182189.680660 3379377.449210 "	" "300:8:1233gw" "	" 769.020447 -558.669556 -553.620728 "
109	" 217 "Gateway" "	" 0x03 "	" -1529131.395080 -5185068.096772 3375866.211487 "	" "300:8:1321gw" "	" -806.250122 228.361389 -7.472396 "
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111	" 220 "Gateway" "	" 0x03 "	" -1529410.127134 -5185154.234272 3375609.745385 "	" "300:8:1345gw" "	" -647.852905 189.471512 3.483542 "
112	" 221 "Gateway" "	" 0x01 "	" -1529144.254750 -5184924.358262 3376081.839165 "	" "300:8:1247gw" "	" -1239.355591 240.393356 -178.419830 "
113	" 225 "Gateway" "	" 0x03 "	" -1531234.805227 -5182181.229120 3379388.079782 "	" "300:8:1233gw" "	" 791.899963 -547.098755 -532.519897 "
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137	" 265 "Gateway" "	" 0x03 "	" -1527817.109731 -5185610.032424 3375619.789259 "	" "300:8:1283gw" "	" -812.141174 199.188644 -54.722775 "
138	" 267 "Gateway" "	" 0x01 "	" -1529158.414372 -5184886.535149 3376133.069641 "	" "300:8:1247gw" "	" -1239.125122 263.863403 -143.423080 "
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148	" 285 "Gateway" "	" 0x01 "	" -1531239.326374 -5181749.255179 3380065.728712 "	" "300:8:1361gw" "	" -275.450104 110.092255 53.841835 "
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156	" 299 "Gateway" "	" 0x01 "	" -1531447.663605 -5187877.111652 3370554.422191 "	" "300:8:1337gw" "	" -256.863281 -24.816236 -155.876282 "
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158	" 302 "Gateway" "	" 0x01 "	" -1531328.824400 -5181981.841862 3379664.322213 "	" "300:8:1349gw" "	" -293.214539 67.366951 -19.466217 "
159	" 305 "Gateway" "	" 0x03 "	" -1531723.604167 -5181895.488020 3379621.362410 "	" "300:8:1360gw" "	" -293.687653 62.621712 -26.797216 "
160	" 308 "Gateway" "	" 0x01 "	" -1531447.553023 -5187877.842383 3370554.934733 "	" "300:8:1339gw" "	" -207.903214 -73.106064 -205.727386 "
161	" 309 "Gateway" "	" 0x03 "	" -1525514.753608 -5185510.235605 3376781.025234 "	" "300:8:1300gw" "	" 191.163345 -13.182029 64.221420 "
162	" 311 "Gateway" "	" 0x03 "	" -1529171.517038 -5185162.638372 3375702.389866 "	" "300:8:1254gw" "	" -804.724060 91.450569 -215.174286 "
163	" 312 "Gateway" "	" 0x03 "	" -1529410.716200 -5185138.393452 3375633.748541 "	" "300:8:1346gw" "	" -647.281982 70.097885 -178.149673 "
164	" 314 "Gateway" "	" 0x03 "	" -1529171.517038 -5185162.638372 3375702.389866 "	" "300:8:1321gw" "	" -814.276978 174.559769 -93.412216 "
165	" 316 "Gateway" "	" 0x03 "	" -1511793.865065 -5177222.899919 3395525.530308 "	" "300:2:1284gw" "	" 57.293369 94.513725 169.192810 "
166	" 317 "Gateway" "	" 0x03 "	" -1529171.517038 -5185162.638372 3375702.389866 "	" "300:8:1254gw" "	" -803.977356 88.528503 -219.150787 "
167	" 319 "Gateway" "	" 0x01 "	" -1531272.993092 -5181891.486361 3379827.209271 "	" "300:8:1376gw" "	" -286.723083 91.075569 19.675411 "

168	" 320 "Gateway" "	" 0x01 "	" -1531569.980618 -5182186.673861 3379236.548394 "	" "300:8:1375gw" "	" -293.668579 61.696487 -29.056984 "
169	" 325 "Gateway" "	" 0x01 "	" -1512216.246278 -5177651.792064 3394694.513853 "	" "300:2:1284gw" "	" 45.370552 98.780693 170.368622 "
170	" 326 "Gateway" "	" 0x03 "	" -1529364.438694 -5185365.613139 3375305.508696 "	" "300:8:1283gw" "	" -812.103821 127.163208 -162.975098 "
171	" 327 "Gateway" "	" 0x03 "	" -1529415.187986 -5185141.407871 3375627.471904 "	" "300:8:1346gw" "	" -644.505066 61.199818 -191.030991 "
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173	" 329 "Gateway" "	" 0x03 "	" -1529450.684498 -5184685.176818 3376309.228935 "	" "300:8:1326gw" "	" -1147.432129 496.555267 249.914566 "
174	" 333 "Gateway" "	" 0x03 "	" -1529471.508739 -5185346.708196 3375289.295941 "	" "300:8:1345gw" "	" -656.226257 125.749214 -95.808136 "
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177	" 341 "Gateway" "	" 0x03 "	" -1529171.517038 -5185162.638372 3375702.389866 "	" "300:8:1321gw" "	" -813.819885 179.265671 -88.345879 "
178	" 342 "Gateway" "	" 0x03 "	" -1529364.438694 -5185365.613139 3375305.508696 "	" "300:8:1283gw" "	" -810.855225 118.922523 -174.971985 "
179	" 343 "Gateway" "	" 0x03 "	" -1531719.980889 -5181940.158346 3379551.199207 "	" "300:8:1349gw" "	" -293.597351 63.481461 -25.742983 "
180	" 346 "Gateway" "	" 0x03 "	" -1531807.017416 -5181861.682948 3379637.699571 "	" "300:8:1373gw" "	" -293.903229 55.239346 -38.229763 "
181	" 347 "Gateway" "	" 0x01 "	" -1529364.714509 -5185367.015984 3375305.839241 "	" "300:8:1283gw" "	" -810.493774 116.897430 -177.985458 "
182	" 349 "Gateway" "	" 0x03 "	" -1529464.493250 -5185357.123204 3375275.878899 "	" "300:8:1318gw" "	" -645.486450 63.705242 -186.852646 "
183	" 351 "Gateway" "	" 0x01 "	" -1529364.321058 -5185367.763785 3375305.611648 "	" "300:8:1326gw" "	" -587.895325 -45.880527 -328.479950 "
184	" 353 "Gateway" "	" 0x01 "	" -1529364.506561 -5185365.910079 3375305.667595 "	" "300:8:1353gw" "	" -596.715698 -32.362480 -313.859863 "
185	" 354 "Gateway" "	" 0x03 "	" -1529471.777675 -5185357.624402 3375272.437979 "	" "300:8:1318gw" "	" -643.654846 57.686337 -194.950516 "
186	" 357 "Gateway" "	" 0x03 "	" -1531722.033621 -5181939.652306 3379551.102761 "	" "300:8:1349gw" "	" -293.597351 63.481461 -25.742983 "
187	" 358 "Gateway" "	" 0x03 "	" -1531897.781899 -5182107.257629 3379213.957782 "	" "300:8:1361gw" "	" -292.802338 70.094597 -15.669857 "
188	" 359 "Gateway" "	" 0x01 "	" -1531236.143080 -5181851.691612 3379904.427809 "	" "300:8:1358gw" "	" -276.043701 109.328278 52.337440 "
189	" 360 "Gateway" "	" 0x01 "	" -1515526.005763 -5176829.196175 3394472.407842 "	" "300:2:1316gw" "	" -292.861237 59.145420 -40.325077 "
190	" 365 "Gateway" "	" 0x03 "	" -1512569.091292 -5177451.369524 3394837.048969 "	" "300:2:1309gw" "	" 192.888519 -60.063980 -5.283695 "
191	" 366 "Gateway" "	" 0x03 "	" -1512566.864921 -5177444.738899 3394847.736640 "	" "300:2:1292gw" "	" 194.772141 -53.642666 5.278380 "
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196	" 374 "Gateway" "	" 0x03 "	" -1531710.590947 -5181942.224358 3379552.039364 "	" "300:8:1349gw" "	" -293.597351 63.481461 -25.742983 "
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73

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297	" 567 "Gateway" "	" 0x03 "	" -1531104.108855 -5182156.704367 3379484.329187 "	" "300:8:1360gw" "	" 1050.242920 -322.553802 -54.304043 "
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314	" 607 "Gateway" "	" 0x03 "	" -1534085.232007 -5184057.896192 3375194.187559 "	" "300:8:1286gw" "	" 152.335129 38.661823 127.046669 "
315	" 609 "Gateway" "	" 0x01 "	" -1536630.554217 -5184788.360320 3372918.769272 "	" "300:8:1353gw" "	" 39.895988 59.571678 -69.710297 "
316	" 610 "Gateway" "	" 0x01 "	" -1534520.174527 -5184101.512790 3374923.527780 "	" "300:8:1285gw" "	" 140.847580 48.627003 136.524567 "
317	" 612 "Gateway" "	" 0x01 "	" -1534614.453224 -5184082.243193 3374911.074475 "	" "300:8:1285gw" "	" 137.988647 50.948116 138.582123 "
318	" 615 "Gateway" "	" 0x01 "	" -1536245.221637 -5185119.931176 3372594.336804 "	" "300:8:1346gw" "	" 5.013741 87.910522 -47.398335 "
319	" 616 "Gateway" "	" 0x05 "	" -1523478.150000 -5175611.300000 3392705.290000 "	" "" "	" 0.000000 0.000000 0.000000 "
320	" 617 "Gateway" "	" 0x05 "	" -1523478.150000 -5175611.300000 3392705.290000 "	" "" "	" 0.000000 0.000000 0.000000 "
321	" 618 "Gateway" "	" 0x05 "	" -1523541.890000 -5175585.070000 3392716.560000 "	" "" "	" 0.000000 0.000000 0.000000 "
322	" 619 "Gateway" "	" 0x05 "	" -1523541.890000 -5175585.070000 3392716.560000 "	" "" "	" 0.000000 0.000000 0.000000 "
323	" 620 "Gateway" "	" 0x05 "	" -1523399.150000 -5175646.660000 3392687.000000 "	" "" "	" 0.000000 0.000000 0.000000 "
324	" 621 "Gateway" "	" 0x05 "	" -1523399.150000 -5175646.660000 3392687.000000 "	" "" "	" 0.000000 0.000000 0.000000 "
325	" 622 "Gateway" "	" 0x05 "	" -1523539.330000 -5175564.560000 3392747.440000 "	" "" "	" 0.000000 0.000000 0.000000 "
326	" 623 "Gateway" "	" 0x05 "	" -1523539.330000 -5175564.560000 3392747.440000 "	" "" "	" 0.000000 0.000000 0.000000 "
327	" 624 "Gateway" "	" 0x05 "	" -1523461.780000 -5175583.320000 3392752.940000 "	" "" "	" 0.000000 0.000000 0.000000 "
328	" 625 "Gateway" "	" 0x05 "	" -1523461.780000 -5175583.320000 3392752.940000 "	" "" "	" 0.000000 0.000000 0.000000 "
329	" 627 "Gateway" "	" 0x05 "	" -1523405.550000 -5175615.580000 3392729.740000 "	" "" "	" 0.000000 0.000000 0.000000 "
330	" 628 "Gateway" "	" 0x05 "	" -1523405.550000 -5175615.580000 3392729.740000 "	" "" "	" 0.000000 0.000000 0.000000 "
331	" 633 "Gateway" "	" 0x03 "	" -1537347.674462 -5184730.704798 3372667.131784 "	" "300:8:1345gw" "	" -560.016724 -76.814491 -368.925201 "
332	" 636 "Gateway" "	" 0x01 "	" -1536513.853500 -5185187.224400 3372371.890493 "	" "300:8:1353gw" "	" 27.243469 76.412674 -58.471333 "
333	" 638 "Gateway" "	" 0x03 "	" -1537166.324062 -5184707.542960 3372788.401549 "	" "300:8:1345gw" "	" -1054.858154 -148.365875 -700.633118 "
334	" 639 "Gateway" "	" 0x03 "	" -1515874.765380 -5176761.085086 3394415.706246 "	" "300:2:1349gw" "	" -282.099823 12.930839 -105.567451 "
335	" 641 "Gateway" "	" 0x03 "	" -1513258.473649 -5177508.709068 3394444.360987 "	" "300:2:1301gw" "	" 922.350708 -361.372101 -136.672379 "
336	" 643 "Gateway" "	" 0x01 "	" -1515511.569404 -5176775.739670 3394557.264422 "	" "300:2:1300gw" "	" -626.512939 237.202927 82.712265 "
337	" 648 "Gateway" "	" 0x03 "	" -1513226.191367 -5177453.684866 3394543.668448 "	" "300:2:1301gw" "	" 933.557251 -343.058228 -103.835869 "
338	" 651 "Gateway" "	" 0x03 "	" -1517602.182017 -5175833.320350 3395024.089858 "	" "300:2:1304gw" "	" -601.240662 270.610840 144.583588 "
339	" 652 "Gateway" "	" 0x03 "	" -1517165.671910 -5176119.330014 3394788.482409 "	" "300:2:1267gw" "	" -620.846863 246.386932 97.302025 "

340	" 654 "Gateway" "	" 0x01 "	" -1515511.672544 -5176775.960647 3394556.086546 "	" "300:2:1349gw" "	" -282.099823 12.930839 -105.567451 "
341	" 658 "Gateway" "	" 0x03 "	" -1536443.090548 -5185122.049506 3372498.524545 "	" "300:8:1353gw" "	" -332.959167 -252.992477 -529.866028 "
342	" 659 "Gateway" "	" 0x03 "	" -1517189.317343 -5176011.806362 3394941.728879 "	" "300:2:1267gw" "	" -614.731445 255.116867 112.452744 "
343	" 662 "Gateway" "	" 0x03 "	" -1536461.290448 -5185127.662526 3372481.954039 "	" "300:8:1306gw" "	" -352.324158 -242.015930 -522.418396 "
344	" 663 "Gateway" "	" 0x03 "	" -1513176.585655 -5177340.920831 3394732.800408 "	" "300:2:1301gw" "	" 952.267944 -303.246216 -35.035683 "
345	" 666 "Gateway" "	" 0x03 "	" -1517341.901035 -5175714.704076 3395325.119184 "	" "300:2:1269gw" "	" -547.950623 316.228943 235.317627 "
346	" 667 "Gateway" "	" 0x03 "	" -1517114.459705 -5175862.501776 3395203.889291 "	" "300:2:1267gw" "	" -594.756897 278.267700 156.385162 "
347	" 668 "Gateway" "	" 0x03 "	" -1513144.485727 -5177223.180709 3394923.501783 "	" "300:2:1301gw" "	" 964.529541 -261.871704 33.256027 "
348	" 671 "Gateway" "	" 0x01 "	" -1514681.240543 -5177222.483136 3394247.866472 "	" "300:2:1292gw" "	" 163.635818 -94.891678 -71.136993 "
349	" 673 "Gateway" "	" 0x03 "	" -1513130.243440 -5177020.993123 3395234.257007 "	" "300:2:1301gw" "	" 971.016296 -191.426300 143.120117 "
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351	" 677 "Gateway" "	" 0x03 "	" -1534638.405139 -5184045.208385 3374953.242504 "	" "300:8:1236gw" "	" 914.670105 285.781494 841.030640 "
352	" 681 "Gateway" "	" 0x03 "	" -1537025.784523 -5184996.677579 3372416.876329 "	" "300:8:1326gw" "	" -777.140808 -388.603729 -933.093933 "
353	" 682 "Gateway" "	" 0x03 "	" -1514278.368702 -5177373.709564 3394195.836252 "	" "300:2:1292gw" "	" 169.393402 -90.830246 -62.428562 "
354	" 684 "Gateway" "	" 0x03 "	" -1517620.143978 -5175881.497257 3394942.787700 "	" "300:2:1274gw" "	" -633.427307 225.486603 59.587536 "
355	" 685 "Gateway" "	" 0x03 "	" -1534588.976646 -5183931.449000 3375148.882922 "	" "300:8:1236gw" "	" 828.484802 352.900452 902.606873 "
356	" 686 "Gateway" "	" 0x03 "	" -1518041.881865 -5175709.811737 3395004.767570 "	" "300:2:1304gw" "	" -630.924500 230.234482 67.463799 "
357	" 690 "Gateway" "	" 0x03 "	" -1513526.601903 -5176180.719180 3396334.826828 "	" "300:2:1301gw" "	" 833.460266 111.296623 541.255066 "
358	" 694 "Gateway" "	" 0x03 "	" -1536550.968818 -5185052.555615 3372553.137496 "	" "300:8:1346gw" "	" -314.156464 -262.404236 -536.725952 "
359	" 695 "Gateway" "	" 0x03 "	" -1517570.885363 -5175941.819502 3394873.682966 "	" "300:2:1267gw" "	" -640.011475 211.532196 35.559391 "
360	" 697 "Gateway" "	" 0x03 "	" -1513748.331498 -5176022.387807 3396476.353542 "	" "300:2:1292gw" "	" 763.049561 183.866196 619.635803 "
361	" 699 "Gateway" "	" 0x03 "	" -1517836.439461 -5175478.957157 3395454.715032 "	" "300:2:1278gw" "	" -571.368164 299.419250 198.775146 "
362	" 700 "Gateway" "	" 0x03 "	" -1513663.537057 -5175972.033685 3396590.111630 "	" "300:2:1309gw" "	" 783.306213 164.358078 599.514648 "
363	" 701 "Gateway" "	" 0x03 "	" -1518188.267831 -5175791.806403 3394811.721182 "	" "300:2:1304gw" "	" -645.542725 196.956116 10.385013 "
364	" 702 "Gateway" "	" 0x03 "	" -1513992.159471 -5175822.766031 3396670.566344 "	" "300:2:1292gw" "	" 677.435608 255.077454 689.939514 "
365	" 704 "Gateway" "	" 0x03 "	" -1513854.732016 -5175804.194551 3396759.517367 "	" "300:2:1309gw" "	" 715.361816 224.104034 661.841980 "
366	" 706 "Gateway" "	" 0x03 "	" -1517659.339270 -5175293.374649 3395816.232218 "	" "300:2:1277gw" "	" -518.574402 333.816040 274.358185 "
367	" 710 "Gateway" "	" 0x03 "	" -1514374.685566 -5175572.870512 3396879.378778 "	" "300:2:1292gw" "	" 542.899658 344.028229 766.096985 "
368	" 713 "Gateway" "	" 0x01 "	" -1536640.490667 -5184829.060049 3372851.433696 "	" "300:8:1345gw" "	" -812.708008 -364.027130 -912.477356 "
369	" 714 "Gateway" "	" 0x03 "	" -1517882.524332 -5175870.874531 3394835.620504 "	" "300:2:1271gw" "	" -643.774109 202.015854 19.222919 "
370	" 716 "Gateway" "	" 0x03 "	" -1514494.935453 -5175505.195260 3396926.709328 "	" "300:2:1292gw" "	" 498.720306 369.027466 784.281067 "
371	" 719 "Gateway" "	" 0x03 "	" -1517557.744413 -5176044.839018 3394723.491397 "	" "300:2:1227gw" "	" -650.842590 177.806366 -20.342138 "
372	" 721 "Gateway" "	" 0x01 "	" -1536463.141667 -5185215.010237 3372353.447900 "	" "300:8:1326gw" "	" 2.071700 86.545280 -50.056190 "
373	" 723 "Gateway" "	" 0x03 "	" -1517935.466520 -5176038.209639 3394553.576912 "	" "300:2:1274gw" "	" -655.136353 147.228226 -68.885254 "
374	" 726 "Gateway" "	" 0x03 "	" -1514914.112474 -5175307.800075 3397041.642376 "	" "300:2:1292gw" "	" 350.858673 440.375214 826.418701 "
375	" 730 "Gateway" "	" 0x03 "	" -1515044.412425 -5175141.612419 3397235.398725 "	" "300:2:1309gw" "	" 295.718933 461.784454 836.244812 "
376	" 732 "Gateway" "	" 0x03 "	" -1518424.416083 -5176101.614473 3394248.411773 "	" "300:2:1304gw" "	" -651.140747 91.322464 -152.646515 "
377	" 736 "Gateway" "	" 0x01 "	" -1535480.708011 -5183757.486289 3375021.247117 "	" "300:8:1306gw" "	" -341.800079 -304.226532 -574.709595 "
378	" 738 "Gateway" "	" 0x03 "	" -1515299.650035 -5175052.839946 3397256.648244 "	" "300:2:1309gw" "	" 204.549805 494.966248 844.492615 "
379	" 740 "Gateway" "	" 0x03 "	" -1518281.609448 -5175581.940482 3395091.798717 "	" "300:2:1269gw" "	" -632.511169 227.524612 61.539871 "
380	" 741 "Gateway" "	" 0x01 "	" -1536244.016297 -5185136.498294 3372567.285488 "	" "300:8:1326gw" "	" -202.824493 -312.892975 -562.659058 "
381	" 743 "Gateway" "	" 0x03 "	" -1536274.274923 -5185231.478394 3372409.901098 "	" "300:8:1353gw" "	" -228.315842 -644.853760 -1075.946289 "
382	" 744 "Gateway" "	" 0x03 "	" -1515384.252794 -5175026.644121 3397258.799572 "	" "300:2:1309gw" "	" 172.661667 505.849884 845.164978 "

383	" 746 "Gateway" "	" 0x01 "	" -1536245.221637 -5185119.931176 3372594.336804 "	" "300:8:1318gw" "	" -17.555529 88.024162 -44.085720 "
384	" 749 "Gateway" "	" 0x03 "	" -1518364.330945 -5176394.100923 3393839.004273 "	" "300:2:1304gw" "	" -626.165344 18.973026 -251.360214 "
385	" 750 "Gateway" "	" 0x03 "	" -1518158.290161 -5176023.659957 3394470.153597 "	" "300:2:1271gw" "	" -655.144104 122.015114 -107.347572 "
386	" 751 "Gateway" "	" 0x03 "	" -1518098.004603 -5176669.017263 3393530.827540 "	" "300:2:1300gw" "	" -580.606445 -53.099190 -340.149414 "
387	" 753 "Gateway" "	" 0x03 "	" -1518280.234514 -5176553.793889 3393628.147771 "	" "300:2:1304gw" "	" -603.070251 -21.461735 -302.441193 "
388	" 755 "Gateway" "	" 0x03 "	" -1536749.837737 -5184924.863341 3372655.981829 "	" "300:8:1247gw" "	" -289.393250 -274.307587 -544.639221 "
389	" 756 "Gateway" "	" 0x03 "	" -1518498.786909 -5175831.997525 3394617.226820 "	" "300:2:1269gw" "	" -654.417297 155.027954 -57.700520 "
390	" 760 "Gateway" "	" 0x03 "	" -1536867.240179 -5185506.267519 3371719.048281 "	" "300:8:1318gw" "	" -463.443359 -558.267822 -1048.418945 "
391	" 761 "Gateway" "	" 0x01 "	" -1515868.710022 -5176560.768442 3394720.885691 "	" "300:2:1277gw" "	" -609.953613 -8.689136 -288.974213 "
392	" 762 "Gateway" "	" 0x03 "	" -1517940.596124 -5176947.597727 3393186.461217 "	" "300:2:1304gw" "	" -521.814514 -116.493561 -412.024078 "
393	" 763 "Gateway" "	" 0x03 "	" -1518544.420703 -5176117.801205 3394176.439587 "	" "300:2:1269gw" "	" -649.534363 84.111954 -163.264404 "
394	" 764 "Gateway" "	" 0x03 "	" -1515259.941353 -5176461.061610 3395144.341770 "	" "300:2:1271gw" "	" -621.389954 5.797917 -263.563782 "
395	" 767 "Gateway" "	" 0x01 "	" -1515840.634132 -5176458.172152 3394889.164840 "	" "300:2:1269gw" "	" -619.644043 7.888760 -267.589325 "
396	" 768 "Gateway" "	" 0x03 "	" -1517930.410630 -5176613.431189 3393687.236098 "	" "300:2:1274gw" "	" -588.531494 -42.872166 -327.746338 "
397	" 770 "Gateway" "	" 0x03 "	" -1516869.139097 -5177516.451157 3392812.526952 "	" "300:2:1300gw" "	" -302.007324 -266.946472 -541.438965 "
398	" 771 "Gateway" "	" 0x03 "	" -1517739.254400 -5176832.594704 3393445.816425 "	" "300:2:1274gw" "	" -536.671997 -103.203506 -396.178192 "
399	" 775 "Gateway" "	" 0x03 "	" -1516708.932018 -5177503.001204 3392906.237874 "	" "300:2:1300gw" "	" -247.567902 -292.414825 -555.723572 "
400	" 776 "Gateway" "	" 0x03 "	" -1516698.661103 -5177552.670880 3392835.877248 "	" "300:2:1304gw" "	" -226.659180 -301.247620 -559.911133 "
401	" 779 "Gateway" "	" 0x03 "	" -1517223.342118 -5176565.961792 3394084.348206 "	" "300:2:1278gw" "	" -483.910736 -144.755249 -447.773712 "
402	" 780 "Gateway" "	" 0x03 "	" -1513436.768774 -5175609.001821 3397239.915542 "	" "300:2:1276gw" "	" 530.572327 101.677345 404.697113 "
403	" 781 "Gateway" "	" 0x05 "	" -1517934.552468 -5163544.841723 3413364.938890 "	" "700:1:702gw" "	" 0.000000 0.000000 0.000000 "
404	" 783 "Gateway" "	" 0x01 "	" -1515719.642362 -5176023.124790 3395607.365505 "	" "300:2:1276gw" "	" 883.678223 296.766418 869.866394 "
405	" 786 "Gateway" "	" 0x01 "	" -1515794.403982 -5176041.103117 3395543.417005 "	" "300:2:1268gw" "	" 782.695740 371.481750 935.421692 "
406	" 788 "Gateway" "	" 0x01 "	" -1515886.519560 -5175889.608791 3395732.716004 "	" "300:2:1286gw" "	" 586.327332 485.054047 1023.018982 "
407	" 790 "Gateway" "	" 0x01 "	" -1515899.594511 -5175874.913059 3395749.610263 "	" "300:2:1268gw" "	" 467.612030 544.977234 1053.548218 "
408	" 795 "Gateway" "	" 0x01 "	" -1516075.086777 -5175618.012422 3396057.921787 "	" "300:2:1286gw" "	" 140.880066 662.650085 1080.126221 "
409	" 796 "Gateway" "	" 0x01 "	" -1516083.900102 -5175604.353140 3396073.563171 "	" "300:2:1276gw" "	" 130.297455 665.883484 1079.465942 "
410	" 797 "Gateway" "	" 0x05 "	" -1518007.671469 -5163724.960046 3413063.240151 "	" "700:1:702gw" "	" 0.000000 0.000000 0.000000 "
411	" 799 "Gateway" "	" 0x01 "	" -1516196.086696 -5176240.919459 3395051.400284 "	" "300:2:1349gw" "	" -148.298340 -110.537033 -238.078064 "
412	" 801 "Gateway" "	" 0x01 "	" -1515953.256727 -5175722.147135 3395957.328273 "	" "300:2:1276gw" "	" 323.744568 603.904297 1075.227417 "
413	" 804 "Gateway" "	" 0x01 "	" -1516083.501891 -5175624.466284 3396044.742033 "	" "300:2:1268gw" "	" 141.069183 663.704590 1079.453857 "
414	" 805 "Gateway" "	" 0x03 "	" -1516358.562139 -5176297.160563 3394888.833491 "	" "300:2:1329gw" "	" -208.871719 -70.748909 -205.570419 "
415	" 810 "Gateway" "	" 0x03 "	" -1516272.532795 -5176178.987892 3395106.447482 "	" "300:2:1335gw" "	" -197.820740 -78.901894 -213.385681 "
416	" 811 "Gateway" "	" 0x03 "	" -1513604.361077 -5175455.451352 3397398.107841 "	" "300:2:1276gw" "	" 499.796204 131.114014 434.324585 "
417	" 812 "Gateway" "	" 0x03 "	" -1516353.120801 -5176295.269212 3394894.124699 "	" "300:2:1329gw" "	" -208.871719 -70.748909 -205.570419 "
418	" 814 "Gateway" "	" 0x03 "	" -1516294.806852 -5176188.197077 3395082.250716 "	" "300:2:1335gw" "	" -197.820740 -78.901894 -213.385681 "
419	" 816 "Gateway" "	" 0x03 "	" -1516290.785263 -5176279.745228 3394945.284070 "	" "300:2:1250gw" "	" -196.233215 -79.969780 -214.451309 "
420	" 818 "Gateway" "	" 0x01 "	" -1516196.552955 -5176240.767398 3395051.591674 "	" "300:2:1329gw" "	" -208.871719 -70.748909 -205.570419 "
421	" 819 "Gateway" "	" 0x03 "	" -1513603.794463 -5175455.916203 3397397.655193 "	" "300:2:1276gw" "	" 499.796204 131.114014 434.324585 "
422	" 822 "Gateway" "	" 0x01 "	" -1515852.912019 -5176003.564864 3395575.790909 "	" "300:2:1286gw" "	" 443.923370 173.680222 477.903992 "
423	" 823 "Gateway" "	" 0x03 "	" -1516270.589365 -5176178.265153 3395108.359350 "	" "300:2:1335gw" "	" -197.820740 -78.901894 -213.385681 "
424	" 825 "Gateway" "	" 0x03 "	" -1516309.844938 -5176194.980441 3395065.213961 "	" "300:2:1335gw" "	" -197.820740 -78.901894 -213.385681 "
425	" 828 "Gateway" "	" 0x05 "	" -1518056.991786 -5163483.633269 3413405.215743 "	" "700:1:702gw" "	" 0.000000 0.000000 0.000000 "

Table F-2 MunitionDetonation events log record (part 2 - remaining fields)

index	Fuse Type	Munition Object Identifier	Munition Type	Quantity Fired	Rate Of Fire	Relative Detonation Location	Target Object Identifier	Warhead Type
1	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" -0.043465 -0.261724 -1.748757 "	" "300:8:1240gw" "	" 1600 "
2	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
3	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
4	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
5	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
6	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
7	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
8	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000577 0.155480 -1.769039 "	" "300:8:1240gw" "	" 1600 "
9	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
10	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
11	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" -0.426856 1.387467 -0.219724 "	" "300:8:1237gw" "	" 1600 "
12	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
13	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
14	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
15	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
16	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
17	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
18	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
19	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
20	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.099502 -0.857445 -1.368549 "	" "300:8:1257gw" "	" 1600 "
21	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
22	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
23	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
24	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
25	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
26	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
27	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
28	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
29	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
30	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
31	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
32	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
33	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
34	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.921657 -0.339106 -2.091375 "	" "300:8:1225gw" "	" 5000 "
35	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.531528 -0.201208 -1.048116 "	" "300:8:1225gw" "	" 5000 "
36	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" -0.514409 0.330121 -0.944083 "	" "300:8:1225gw" "	" 5000 "
37	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
38	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.058417 -0.686426 -2.461991 "	" "300:8:1257gw" "	" 1200 "

39	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
40	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.073446 0.553847 -1.813825 "	" "300:8:1257gw" "	" 1200 "
41	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
42	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 1.153606 0.794216 -2.014180 "	" "300:8:1279gw" "	" 1200 "
43	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
44	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.022030 0.053659 -0.702935 "	" "300:8:1258gw" "	" 1200 "
45	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.104436 0.494342 -0.949997 "	" "300:8:1258gw" "	" 1600 "
46	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.136084 0.025269 -0.405902 "	" "300:8:1280gw" "	" 1200 "
47	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.672789 -0.110106 -2.033983 "	" "300:8:1280gw" "	" 1200 "
48	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" -1.464540 -0.783890 -1.541705 "	" "300:8:1223gw" "	" 1600 "
49	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" 1.116507 -0.277227 -0.088474 "	" "300:8:1279gw" "	" 1600 "
50	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" 0.871756 -0.086013 -1.608272 "	" "300:8:1221gw" "	" 1600 "
51	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
52	" 2000 "	" "" "	" 0x02 0x09 225 0x02 0x0e 0x02 0x02 "	" 1 "	" 0 "	" 0.000000 0.000000 0.000000 "	" "" "	" 1500 "
53	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.339180 -0.009386 -1.937987 "	" "300:8:1344gw" "	" 5000 "
54	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
55	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
56	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.156435 0.236932 -1.528018 "	" "300:8:1257gw" "	" 1600 "
57	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
58	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.291046 -0.048115 -0.372741 "	" "300:8:1322gw" "	" 1200 "
59	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.101016 0.174248 -2.406553 "	" "300:8:1295gw" "	" 1600 "
60	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.350459 0.180514 -0.769589 "	" "300:8:1233gw" "	" 5000 "
61	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.753529 0.255845 -1.251686 "	" "300:8:1232gw" "	" 5000 "
62	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
63	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" -0.025134 0.032043 -1.367026 "	" "300:8:1232gw" "	" 5000 "
64	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.446384 0.091520 -1.010391 "	" "300:8:1232gw" "	" 5000 "
65	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.060512 0.142013 -1.277205 "	" "300:8:1251gw" "	" 1200 "
66	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.352339 -0.103676 -1.803378 "	" "300:8:1232gw" "	" 5000 "
67	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" -0.039999 -0.121401 -1.478888 "	" "300:8:1232gw" "	" 5000 "
68	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.061794 -0.183765 -1.280655 "	" "300:8:1232gw" "	" 5000 "
69	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" 0.109809 -0.282501 -1.066380 "	" "300:8:1232gw" "	" 1600 "
70	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 0.000000 "	" "" "	" 5000 "
71	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" -0.166583 0.123377 -1.941094 "	" "300:8:1233gw" "	" 5000 "
72	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
73	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
74	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.058426 0.074172 -1.709618 "	" "300:8:1233gw" "	" 5000 "
75	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" -0.719692 0.228665 -1.847829 "	" "300:8:1233gw" "	" 5000 "
76	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 2.638530 -1.409944 -1.861463 "	" "300:8:1245gw" "	" 5000 "
77	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.392900 -0.004547 -1.129794 "	" "300:8:1233gw" "	" 5000 "
78	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
79	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.001062 -0.209287 -2.175736 "	" "300:8:1245gw" "	" 5000 "
80	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
81	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "

82	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
83	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
84	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
85	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
86	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" -0.324895 0.058426 -1.622985 "	" "300:2:1258gw" "	" 1600 "
87	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
88	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
89	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
90	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
91	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.019093 0.251676 -1.589229 "	" "300:8:1335gw" "	" 1600 "
92	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
93	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
94	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
95	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
96	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
97	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" -0.792414 1.450668 -2.390373 "	" "300:8:1266gw" "	" 1600 "
98	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
99	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
100	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
101	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
102	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
103	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
104	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
105	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.078258 -0.765495 -0.946439 "	" "300:8:1280gw" "	" 1600 "
106	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" -1.150097 0.699204 -1.920005 "	" "300:8:1248gw" "	" 1600 "
107	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
108	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
109	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
110	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
111	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
112	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.916499 -0.671577 -1.133689 "	" "300:8:1222gw" "	" 5000 "
113	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
114	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
115	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
116	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.109226 -0.944362 -1.018981 "	" "300:8:1377gw" "	" 1600 "
117	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
118	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
119	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x0a 0x00 0x00 "	" 1 "	" 0 "	" 0.267138 -0.240733 -0.661536 "	" "400:1:4gw" "	" 1600 "
120	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" -0.004936 -0.215686 -1.578308 "	" "300:8:1239gw" "	" 1600 "
121	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" -0.038669 -0.057010 -1.914694 "	" "300:8:1249gw" "	" 1600 "
122	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
123	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
124	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "

125	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.896353 0.548819 -1.009456 "	" "300:8:1267gw" "	" 1600 "
126	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.071228 0.092884 -1.808659 "	" "300:2:1275gw" "	" 1600 "
127	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" -0.768186 0.977152 -2.166649 "	" "300:8:1374gw" "	" 1600 "
128	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
129	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" -0.721422 0.224272 -2.412257 "	" "300:2:1258gw" "	" 1600 "
130	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
131	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
132	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.591398 0.554296 -1.618074 "	" "300:2:1275gw" "	" 1600 "
133	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.182389 0.805466 -1.865279 "	" "300:8:1304gw" "	" 1600 "
134	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
135	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" -0.031179 -0.163126 -0.513299 "	" "300:8:1350gw" "	" 1600 "
136	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
137	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
138	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" -0.127605 0.303839 -1.081690 "	" "300:8:1256gw" "	" 5000 "
139	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
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143	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
144	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
145	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
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147	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
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149	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.191049 0.335049 -1.811595 "	" "300:8:1277gw" "	" 1600 "
150	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" -0.247172 -0.260120 -0.249213 "	" "300:8:1284gw" "	" 1600 "
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154	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
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156	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.714513 0.537365 -0.634977 "	" "300:8:1249gw" "	" 1600 "
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162	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
163	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
164	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
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166	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
167	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.435704 -0.425562 -2.003652 "	" "300:8:1282gw" "	" 1600 "

168	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.120171 0.198638 -0.938637 "	" "300:8:1284gw" "	" 1600 "
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171	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
172	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
173	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
174	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
175	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" -0.362949 -0.375308 -0.931876 "	" "300:8:1284gw" "	" 1600 "
176	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
177	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
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179	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
180	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
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182	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
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190	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
191	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
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193	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
194	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.321129 1.428403 -1.475246 "	" "300:8:1303gw" "	" 1600 "
195	" 0 "	" "" "	" 0x02 0x09 225 0x02 0x13 0x05 0x00 "	" 20 "	" 700 "	" -0.091581 -0.298801 -0.290937 "	" "300:8:1243gw" "	" 5000 "
196	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
197	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.132881 0.686893 -1.013761 "	" "300:2:1307gw" "	" 1600 "
198	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
199	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.039153 0.156399 -1.976221 "	" "300:2:1348gw" "	" 1600 "
200	" 2000 "	" "" "	" 0x02 0x09 225 0x02 0x0e 0x02 0x02 "	" 1 "	" 0 "	" 0.000000 0.000000 0.000000 "	" "" "	" 1500 "
201	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
202	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
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204	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x0a 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
205	" 2000 "	" "" "	" 0x02 0x09 225 0x02 0x0e 0x02 0x02 "	" 1 "	" 0 "	" 0.000000 0.000000 0.000000 "	" "" "	" 1500 "
206	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
207	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
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239	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
240	" 2000 "	" "" "	" 0x02 0x09 225 0x02 0x0e 0x02 0x02 "	" 1 "	" 0 "	" 0.000000 0.000000 0.000000 "	" "" "	" 1500 "
241	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -1.359263 0.327470 -1.507812 "	" "300:8:1289gw" "	" 1200 "
242	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
243	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" -0.225086 0.037027 -2.016670 "	" "300:8:1259gw" "	" 1600 "
244	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
245	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" -0.101685 -0.007727 -2.378694 "	" "300:8:1259gw" "	" 1600 "
246	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.510987 0.729273 -1.669291 "	" "300:8:1305gw" "	" 1200 "
247	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
248	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
249	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
250	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
251	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
252	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.012635 -0.052616 -1.568120 "	" "300:8:1305gw" "	" 1200 "
253	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.500288 -0.977159 -0.888145 "	" "300:8:1305gw" "	" 1200 "

254	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.299887 -0.564766 -0.639853 "	" "" "	" 1200 "
255	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
256	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
257	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 1.337891 -1.004446 -1.641325 "	" "300:8:1362gw" "	" 5000 "
258	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.005875 0.113945 -0.981870 "	" "" "	" 1200 "
259	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.304529 -0.251336 -1.253233 "	" "300:8:1305gw" "	" 1200 "
260	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
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262	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
263	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.034095 -0.069179 -0.639649 "	" "300:8:1305gw" "	" 1200 "
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265	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.089154 -0.002232 -0.921645 "	" "300:8:1305gw" "	" 1200 "
266	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.604252 -0.145535 -1.154867 "	" "300:8:1362gw" "	" 5000 "
267	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.370936 0.241756 -0.979820 "	" "300:8:1305gw" "	" 1200 "
268	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.056410 0.111237 -1.246379 "	" "" "	" 1200 "
269	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" -1.735243 0.170964 -1.436094 "	" "300:8:1362gw" "	" 5000 "
270	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 1.529473 0.013386 -0.197979 "	" "300:8:1362gw" "	" 5000 "
271	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.638297 0.124389 -0.257140 "	" "300:8:1305gw" "	" 1200 "
272	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.051665 -0.070238 -1.466157 "	" "300:8:1305gw" "	" 1200 "
273	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
274	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" -0.487263 -0.088308 -1.511910 "	" "300:8:1362gw" "	" 5000 "
275	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 1.595578 -0.033718 -1.054413 "	" "300:8:1305gw" "	" 1200 "
276	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
277	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.254231 -0.059771 -1.619821 "	" "" "	" 1200 "
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284	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
285	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
286	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.117699 -0.031339 -0.654138 "	" "" "	" 1200 "
287	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
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289	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
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294	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.115224 0.446495 -0.657109 "		" 1200 "
295	" 2000 "	" "" "	" 0x02 0x09 225 0x02 0x0e 0x02 0x02 "	" 1 "	" 0 "	" 0.000000 0.000000 0.000000 "	" "" "	" 1500 "
296	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" -0.033689 -0.009628 -1.580570 "	" "" "	" 1200 "

297	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
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300	" 2000 "	" "" "	" 0x02 0x09 225 0x02 0x0e 0x02 0x02 "	" 1 "	" 0 "	" 0.000000 0.000000 0.000000 "	" "" "	" 1500 "
301	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
302	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
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305	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
306	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
307	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
308	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
309	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
310	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x03 0x07 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1200 "
311	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
312	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x0a 0x00 0x00 "	" 1 "	" 0 "	" 0.538204 0.801793 -0.435160 "	" "300:8:1353gw" "	" 1600 "
313	" 2000 "	" "" "	" 0x02 0x09 225 0x02 0x0e 0x02 0x02 "	" 1 "	" 0 "	" 0.000000 0.000000 0.000000 "	" "" "	" 1500 "
314	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
315	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x20 0x02 "	" 1 "	" 0 "	" 0.006575 0.017252 -2.019916 "	" "300:8:1286gw" "	" 1600 "
316	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" -0.423794 -0.414786 -1.258702 "	" "300:8:1353gw" "	" 1600 "
317	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.350695 0.328173 -1.645453 "	" "300:8:1353gw" "	" 1600 "
318	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x20 0x02 "	" 1 "	" 0 "	" 0.000000 0.000000 -2.020000 "	" "300:8:1332gw" "	" 1600 "
319	" 5000 "	" "" "	" 0x02 0x09 222 0x02 0x13 0x00 0x00 "	" 1 "	" 1 "	" 0.000000 0.000000 0.000000 "	" "" "	" 8110 "
320	" 5000 "	" "" "	" 0x02 0x09 222 0x02 0x13 0x00 0x00 "	" 1 "	" 1 "	" 0.000000 0.000000 0.000000 "	" "" "	" 8110 "
321	" 5000 "	" "" "	" 0x02 0x09 222 0x02 0x13 0x00 0x00 "	" 1 "	" 1 "	" 0.000000 0.000000 0.000000 "	" "" "	" 8110 "
322	" 5000 "	" "" "	" 0x02 0x09 222 0x02 0x13 0x00 0x00 "	" 1 "	" 1 "	" 0.000000 0.000000 0.000000 "	" "" "	" 8110 "
323	" 5000 "	" "" "	" 0x02 0x09 222 0x02 0x13 0x00 0x00 "	" 1 "	" 1 "	" 0.000000 0.000000 0.000000 "	" "" "	" 8110 "
324	" 5000 "	" "" "	" 0x02 0x09 222 0x02 0x13 0x00 0x00 "	" 1 "	" 1 "	" 0.000000 0.000000 0.000000 "	" "" "	" 8110 "
325	" 5000 "	" "" "	" 0x02 0x09 222 0x02 0x13 0x00 0x00 "	" 1 "	" 1 "	" 0.000000 0.000000 0.000000 "	" "" "	" 8110 "
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331	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
332	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x20 0x02 "	" 1 "	" 0 "	" -0.008424 0.006765 -2.019971 "	" "300:8:1325gw" "	" 1600 "
333	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
334	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
335	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
336	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.202835 -0.934959 -1.450113 "	" "300:2:1312gw" "	" 1600 "
337	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
338	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
339	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "

340	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.205501 0.025531 -1.031020 "	" "300:2:1312gw" "	" 1600 "
341	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
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345	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
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349	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
350	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
351	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
352	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
353	" 0 "	" "" "	" 0x02 0x02 222 0x01 0x07 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
354	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
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356	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
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360	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
361	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
362	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
363	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
364	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
365	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
366	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
367	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
368	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.705989 -0.218382 -0.693774 "	" "300:8:1236gw" "	" 5000 "
369	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
370	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
371	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
372	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x20 0x02 "	" 1 "	" 0 "	" 0.094197 0.003516 -2.018313 "	" "300:8:1290gw" "	" 1600 "
373	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
374	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
375	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
376	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
377	" 0 "	" "300:8:1565gw" "	" 0x02 0x02 225 0x02 0x0d 0x1f 0x03 "	" 1 "	" 0 "	" 4.282112 -1.016763 -5.902610 "	" "300:8:1254gw" "	" 1000 "
378	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
379	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
380	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" -0.572783 -0.425130 -0.764285 "	" "300:8:1278gw" "	" 1600 "
381	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
382	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x02 0x02 0x01 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "

383	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x20 0x02 "	" 1 "	" 0 "	" 0.084666 0.289081 -1.997414 "	" "300:8:1332gw" "	" 1600 "
384	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
385	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
386	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
387	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
388	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
389	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
390	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x08 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 5000 "
391	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" -0.393129 -0.727626 -0.976209 "	" "300:2:1292gw" "	" 1600 "
392	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
393	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
394	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
395	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.181867 0.263816 -1.247404 "	" "300:2:1309gw" "	" 1600 "
396	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
397	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
398	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
399	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
400	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
401	" 0 "	" "" "	" 0x02 0x02 225 0x02 0x0d 0x06 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
402	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
403	" 2000 "	" "" "	" 0x02 0x09 225 0x02 0x0e 0x02 0x02 "	" 1 "	" 0 "	" 0.000000 0.000000 0.000000 "	" "" "	" 1500 "
404	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 1.754046 -0.445426 -1.947501 "	" "300:2:1278gw" "	" 5000 "
405	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" -1.757727 0.665846 -1.043457 "	" "300:2:1277gw" "	" 5000 "
406	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 1.438897 -0.718100 -1.105898 "	" "300:2:1278gw" "	" 5000 "
407	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" -0.852912 0.587108 -1.656774 "	" "300:2:1278gw" "	" 5000 "
408	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 0.768059 -0.984830 -1.646936 "	" "300:2:1269gw" "	" 5000 "
409	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" -1.099933 1.538295 -0.790952 "	" "300:2:1269gw" "	" 5000 "
410	" 2000 "	" "" "	" 0x02 0x09 225 0x02 0x0e 0x02 0x02 "	" 1 "	" 0 "	" 0.000000 0.000000 0.000000 "	" "" "	" 1500 "
411	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.563936 0.232377 -1.975886 "	" "300:2:1268gw" "	" 1600 "
412	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" 1.081541 0.053463 -2.332622 "	" "300:2:1357gw" "	" 5000 "
413	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x0b 0x00 0x00 "	" 1 "	" 0 "	" -1.899564 0.136290 -2.033106 "	" "300:2:1359gw" "	" 5000 "
414	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
415	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
416	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
417	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
418	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
419	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
420	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.076074 0.056820 -2.065909 "	" "300:2:1268gw" "	" 1600 "
421	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
422	" 0 "	" "" "	" 0x02 0x02 222 0x02 0x12 0x00 0x00 "	" 1 "	" 0 "	" -0.193491 -0.124063 -1.824543 "	" "300:2:1250gw" "	" 1600 "
423	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
424	" 0 "	" "" "	" 0x02 0x02 225 0x01 0x01 0x00 0x00 "	" 1 "	" 0 "	" 0.000000 0.000000 -0.000000 "	" "" "	" 1600 "
425	" 2000 "	" "" "	" 0x02 0x09 225 0x02 0x0e 0x02 0x02 "	" 1 "	" 0 "	" 0.000000 0.000000 0.000000 "	" "" "	" 1500 "

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Appendix G. Reconciling Entity Tracking Across the Network

Verifying that the server was seeing the same number of entities seen by other applications.

Differences were observed in the entity count between OTB, the MaK Gateway, and the server during the server's validation spirals. This was later reconciled as resulting from a combination of how these individual applications classify entities and as an accounting by-product caused by entities resigning and rejoining the federation. While this phenomenon did not impact vulnerability output it was enough of a concern to warrant an investigation into the causes for the symptoms already mentioned.

The investigation presented in this appendix we concluded that each applications was indeed tracking the same set of entities. Our lessons learned were that it is important to understand the way each application identifies and "entity." It is also vital to ensure delivery of simulation management control messages (such as "delete an entity"). Reliable delivery of "new objects" (new entities) as well as deleted objects may be accomplished via the MaK RTI control parameter "RTI_internalMsgReliable".

This appendix provides some sample observations made during log file reruns supporting these conclusions.

Entity Tracking:

After 50 minutes of (log file playback) simulation (which is enough time to have good confidence that the simulation is able to maintain tracking of entity creation and deletion). The server reported to observe the same number of entities (ground entities) tracked by OTB.

Server reports: entities tracked   : 327
OTB reports: Remote Ground Vehicles: 327

Differences in how "entities" are classified.

On the surface one it would appear that the two simulations (OTB and the server) are in agreement. However, the server does not just subscribe to ground entities. It subscribes to any of the RPR FOM types of "platform" (ground, air, water)[13] by subscribing to the parent object class structure: "ObjectClass BaseEntity.PhysicalEntity.Platform"

OTB also reported 7 air vehicles

Remote Ground Vehicles: 327

---

[13]Under the Platform parent, the RPR FOM has GroundVehicle, Aircraft, Spacecraft, AmphibiousVehicle, and other subclasses.

Remote Air Vehicles: 7

in the FOM. There could be a classification disparity between the 3 applications (the Gateway, OTB, the server and how they interpret these domains under a "platform" super class). This needs to be understood before a valid comparison can be made.

This examination was restarted with only GroundVehicle subscribed to by the server. Ground vehicle is a subclass of the Platform object in the RPR FOM. We observered:

OTB Reported: Remote Ground Vehicles: 328
OTB Reported: Remote Air Vehicles: 7
LV Server Reported: entities tracked: 321

And apparent discrepancy since one would think the LV server and OTB ground vehicles should logically be equal.
We restarted the playback logfile, this time with server subscribing to the Aircraft sub-class:

Server Reported: entities tracked: 6
OTB Reported: Remote Air Vehicles: 7

Again, an apparent discrepancy (since the same number would be expected). However, as we shall see, due to entity filtering, and

Differences in HLA entity filtering

Below an excerpt is shown from a server log file. This log file tracks discovered objects (as received from the RTI). Notice that it shows two objects with the RTIObject Handle 1201069.

```
280  newobject(): Creates: 1200954 : "300:2:1308gw"
281  newobject(): Creates: 1201069 : "300:8:1327gw"
282  newobject(): Creates: 1201069 : "300:8:1279gw"
283  newobject(): Creates: 1201071 : "300:8:1102gw"
284  newobject(): Creates: 1201072 : "300:8:1297gw"
```

During the runs (and reruns) messages were observed on the MaK RTI and gateway warning of duplicated objects (and that one of them would hence forth be ignored). The server doesn't attempt to distinguish weather an object has been mistakenly or otherwise duplicated. This is another explanation of the entity count differences between OTB, gateway, and the server. This is particularly the case since the log files were DIS PDUs (and OTB would interpret the PDUs directly while the server relies on the MaK gateway's DIS to HLA translation of those PDUs). Hence, any entities interpreted as "duplicated" would only be seen once by the server, whereas OTB would presumably see more than one entity (e.g., OTB sees 7 air entities, while the HLA lethality server sees only 6).

Influence of DIS filtering

Other differences in the entity count can be attributed to filtering differences in the way the MaK gateway and OTB were treating PDUs. For example, a difference was observed in the entity count when that count is sorted (viewed) according to "DIS PDU site" (site is a field of the entity state PDU). On the OTB console the "print sites" command may be used as in:

OTBSAF @ LOCALHOST> print sites
Site 100:   1 vehicle
Site 300: 318 vehicles
Site 400:   1 vehicle
Site 500:   1 vehicle
Site 600:   1 vehicle
Site 700:   2 vehicles

This means that OTB observes 1 vehicle from "site 400."   Yet the server's entity creation log at the same instant displays 3 entities that have been created from "site 400":

newobject(): Creates: 300003 : "400:1:5gw"
newobject(): Creates: 300010 : "400:1:4gw"
newobject(): Creates: 300225 : "400:1:6gw"

These same 3 entities are also shown on the MaK Gateway.   Site 400 represents ATC.   The ATC entities in question were Stryker vehicles (either simulated via the VDMS or trans-located from the live Stryker driving on an ATC mobility course). It was well known at ATC that the original PDUs (that were logged locally) issued a non-conforming "DIS Version" identification (a "4" versus the required version "6"). The version of OTB used filters non-version "6" PDUs and this explains why OTB has a smaller number of site 400 (DIS PDU) entities than the (MaK gateway generated HLA) entities recognized by server.

It should be noted that none of these filtering approaches are "wrong." Rather the point is that filtering options for any application should be well understood and configured as desired.

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Appendix H. Reconciling Unknown Entities and Adding Missing Vulnerability Tables

This appendix explains the findings and reviews procedures used to overcome these relatively straight forward issues. Namely, issues of missing lookup tables or target and threat identifiers. In most cases it is sufficient to add the missing data table or unknown entity name to the server's configuration files. In other cases, the observed missing identifier was actually a symptom of a greater problem (data drops). The appendix also offers procedures and recommendations to avoid this as much as possible.

Numerous software and configuration changes were made in the post-run analysis while replaying log files and while evaluating the server's performance using this data feed. Among the three most important configuration changes were modifying the HLA (.fed) file to ensure reliable transmission of fire and detonation events, disabling the "loop play" feature of the playback program, and having the server explicitly request attribute updates for newly discovered entities. The later change avoided numerous instances where an entity with an incomplete data description was involved in an lethality assessment. After these changes a fairly satisfactory execution of the log file playback was seen.

After configuring the HLA federation configuration (the ".fed") file to ensure reliable transmission of detonation events, the server processed all 428 detonations events in the log file. More than two thirds of these (296) could not be assessed because a target was not identified (as often is the case for indirect fire which the server does not currently respond to in any event). For the remaining 132 detonations most (83) could not be evaluated because the server warned that it did not contain a vulnerability table for the target-threat combination. Fortunately as table G-2 shows, these 83 missing vulnerability tables involved most of the same target-threat combinations.

There were also a number of entity names that were unknown (meaning identifiers needed to be added and names associated with those identifiers). In 21 of the 83 missing target-threat vulnerability tables (table H-1) the target (or threat) was not identified in the server's know (named) entity list. These 21 instances only involved 5 different entities listed in table H-2.

Table H-1. Target-threat pairs missing from the vulnerability lookup table database (a straightforward data configuration issue).

	HLA Detonation Event ID[14]	Target Enumeration	Target Name	Threat Enumeration	Threat Name
1	66 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
2	67 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
3	69 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
4	92 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,18,0,0)	120mm HEAT-FS
5	95 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,18,0,0)	120mm HEAT-FS
6	115 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
7	117 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
8	119 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
9	122 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
10	123 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
11	127 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
12	130 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
13	133 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
14	136 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,18,0,0)	120mm HEAT-FS
15	143 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
16	146 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
17	148 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
18	152 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
19	153 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
20	158 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
21	179 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,6,0)	UNKNOWN
22	194 "Gateway"	(1,1,222,1,2,2,0)	T72 MBT	(2,2,225,2,13,6,0)	UNKNOWN
23	231 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,1,7,0,0)	AT-5 Spandrel
24	239 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,1,10,0,0)	AT-8 Songster
25	242 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,2,18,0,0)	120mm HEAT-FS
26	253 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,1,7,0,0)	AT-5 Spandrel
27	261 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,6,0)	UNKNOWN
28	263 "Gateway"	(1,1,225,1,1,3,0)	M1 Abrams	(2,2,222,1,7,0,0)	AT-5 Spandrel
29	289 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,6,0)	UNKNOWN
30	291 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,1,7,0,0)	AT-5 Spandrel
31	294 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,6,0)	UNKNOWN
32	327 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,1,7,0,0)	AT-5 Spandrel
33	349 "Gateway"	(1,1,222,4,18,0,0)	ZSU-23/4Quad	(2,9,225,2,19,5,0)	UNKNOWN
34	351 "Gateway"	(1,1,222,4,18,0,0)	ZSU-23/4Quad	(2,2,225,2,13,6,0)	UNKNOWN
35	354 "Gateway"	(1,1,222,4,18,0,0)	ZSU-23/4Quad	(2,2,225,2,13,6,0)	UNKNOWN
36	356 "Gateway"	(1,1,222,4,18,0,0)	ZSU-23/4Quad	(2,2,225,2,13,6,0)	UNKNOWN
37	375 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,9,225,2,19,5,0)	UNKNOWN
38	382 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,1,7,0,0)	AT-5 Spandrel
39	384 "Gateway"	(1,1,225,2,1,6,0)	FMC M2/M3	(2,2,222,1,7,0,0)	AT-5 Spandrel
40	470 "Gateway"	(1,1,222,4,18,0,0)	ZSU-23/4Quad	(2,2,225,2,3,7,0)	M792 HE-I
41	477 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
42	489 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
43	490 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
44	499 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
45	503 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
46	505 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
47	508 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I

[14]These detonation events (the Detonation EventID field) will not correlate with those captured in appendix F because they represent outputs captured from different simulation spirals. Each time the log file was played back, the MaK gateway was observed to provide slight changes to the "Detonation EventID" sequence. This might be an indication that the gateway was missing some of the (best effort transmitted) universal datagram protocol (UDP) fire and or detonations (DIS PDUs).

48	510 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
49	512 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
50	513 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
51	514 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
52	518 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
53	521 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
54	522 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
55	524 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
56	527 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,2,2,2,1)	30mm SABOT
57	529 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
58	542 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
59	554 "Gateway"	(1,1,222,4,18,0,0)	ZSU-23/4Quad	(2,2,225,2,3,7,0)	M792 HE-I
60	560 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,3,7,0)	M792 HE-I
61	610 "Gateway"	(1,1,225,1,1,3,0)	M1 Abrams	(2,2,222,1,10,0,0)	AT-8 Songster
62	616 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,32,2)	UNKNOWN
63	617 "Gateway"	(1,1,225,1,1,3,0)	M1 Abrams	(2,2,222,1,7,0,0)	AT-5 Spandrel
64	619 "Gateway"	(1,1,225,1,1,3,0)	M1 Abrams	(2,2,222,1,7,0,0)	AT-5 Spandrel
65	622 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,32,2)	UNKNOWN
66	643 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,32,2)	UNKNOWN
67	650 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,6,0)	UNKNOWN
68	678 "Gateway"	(1,1,225,1,1,3,0)	M1 Abrams	(2,2,222,1,7,0,0)	AT-5 Spandrel
69	729 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,32,2)	UNKNOWN
70	745 "Gateway"	(1,1,225,2,30,0,0)	M93 Fox	(2,2,225,2,13,31,3)	UNKNOWN
71	750 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,6,0)	UNKNOWN
72	755 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,32,2)	UNKNOWN
73	770 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,6,0)	UNKNOWN
74	776 "Gateway"	(1,1,222,2,2,1,0)	BMP-2	(2,2,225,2,13,6,0)	UNKNOWN
75	792 "Gateway"	(1,1,225,1,1,3,0)	M1 Abrams	(2,2,222,2,11,0,0)	125mm
76	795 "Gateway"	(1,1,225,1,1,3,0)	M1 Abrams	(2,2,222,2,11,0,0)	125mm
77	797 "Gateway"	(1,1,225,1,1,3,0)	M1 Abrams	(2,2,222,2,11,0,0)	125mm
78	799 "Gateway"	(1,1,225,1,1,3,0)	M1 Abrams	(2,2,222,2,11,0,0)	125mm
79	804 "Gateway"	(1,1,225,1,1,3,0)	M1 Abrams	(2,2,222,2,11,0,0)	125mm
80	805 "Gateway"	(1,1,225,1,1,3,0)	M1 Abrams	(2,2,222,2,11,0,0)	125mm
81	810 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,2,11,0,0)	125mm
82	813 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,2,11,0,0)	125mm
83	831 "Gateway"	(1,1,225,2,1,4,0)	FMC M2/M3	(2,2,222,2,18,0,0)	120mm HEAT-FS

Table H-2. Unidentified entity enumerations.

Enumeration	Entity Description
(3,0,0,32,61,32,48)	UNKNOWN
(2,2,225,2,13,31,3)	US MX943 High Explosive (HE)
(2,2,225,2,13,32,2)	US MX943 HE shaped charge submunition
(2,2,225,2,13,6,0)	munition_US_M830A1 HEAT
(2,9,225,2,19,5,0)	munition_US_M240_KE

It is not critical that the server has a name associated with an entity because all the server needs is a vulnerability table that is associated with an target-threat entity pair. Internally the server uniquely identifies the target and threat each by the 7-tuple numeric enumeration (found in the DIS standard IEEE 1278 DIS Enumeration and Bit coding). Whether or not names are associated with the enumeration does not matter for the entity type identification. Entity names are merely for clarity when results are reviewed. However, according to the server assessment and validation plan, any missing tables (and unknown targets or threats) would be added to the database, and the analysis would then be re-run to verify that the server is missing no tables. By

following this plan (and ensuring names are assigned to entity enumerations) we were able to uncover and address a much more serious problem: that of an incomplete enumeration resulting from data not being received (though it is very possible that it was sent). The example is seen in the first identified UNKNOWN entity shown in table H-2 with enumeration "(3,0,0,32,61,32,48)."

The source detonation event was examined in more detail and this enumeration was determined to be random data, the result of an entity (it was originally a T-72) whose attributes had not been updated during the detonation event. (This entity had been resigned from the federation by the local gateway (perhaps due to a timeout or other reason) and then rejoined but no update was provided. This data drop was fairly unusual. It was the only instance that was still observed after the server's software had been modified to explicitly request attribute updates every time a new object (entity) joins (or re-joins) the federation execution. (In fact this UNKNOWN entity does not appear in the output captured to generate table H-1). After analyzing this incident, procedural and software resolutions were identified to avoid or completely eliminate this fairly rare incident (See PTR's 14, 21, and 30). The analysis and rational for these resolutions are provided in the discussion that follows the conclusion.

Conclusion

After the missing entity names were added as well as missing vulnerability tables, the server no longer produced a "missing vulnerability table" error. (i.e. It had all the data tables that it needed and was able to find when required to service the entities within the scenario.) The server was also able to repeatedly demonstrate that it both identified every entity and could find the vulnerability tables associated with related detonations. There is the possibility of missing important data updates during busy periods or if the scenario is of an overwhelming size. The post-conclusion discussion offers reasons and rational for data dropouts. It is therefore recommended that the server be stress-tested. Stress-testing goes beyond testing that the server is able to service the planned scenario. Being able to service the planned scenario is already incorporated into the server's pre-exercise checklist "5*b. Stimulate the server online using the planned exercise scenario*".

Stress testing is where the entity count is increased until the server begins to fail. A failure could be when the server starts missing critical entity updates, or is otherwise unable to fulfill its roll of determining and providing damage resulting from munition detonation events accurately and fast enough. Stress testing will provide an upper limit measure of the server's ability operate on a specific computer while connecting to specific distributed system architecture and servicing a specific scenario.

Discussion

In analyzing the reasons for the data drop exemplified by the (3,0,0,32,61,32,48) enumeration it was observed that in subsequent reruns this particular incident continued to occur at random intervals at the same low frequency (once or zero times in 400 MunitionDetonations). A possible reason is that the gateway did not detect or respond to the request for attribute updates for the rejoined entity. This seems unlikely since the request is made reliably according to the MaK RTI configuration (".mtl" file) used (see PTR 6). It is therefore more likely that the gateway did receive the update request, but did not respond to it, or, it did send the update, but the server did not detect the (best effort transmitted) update. Solutions: 1) Changing entity updates to a "reliable" data transfer (from the current "best effort"). This is not a reasonable solution because of the extra communications required to transmit the same information and the added possibility of generating a data cascade (data requests caused by other data requests generated by still more data requests. etc.). 2) An alternative solution is to map and maintain the entities' (effectively their DIS) identifiers with their associated HLA object instance identifiers. When an entity is removed from the federation (due to a time out or other reason) it's identifier (the DIS-triple) is remembered, and when a new entity joins the federation and that entity contains the same DIS identifier, then the previously known attributes from that entity are copied into the new entity attribute list prior to receiving new attribute updates. In this manner, even if no new updates are ever received, the pre-existing attributes will still be available. The advantage is that this software modification would solve the technical issue that results from (on these rare occasions) not obtaining an attribute update. The disadvantage is this requires a moderate software modification (creating a duplicate entity master list that has special treatment) and this modification will only be specific to the RPR-FOM.

Missing an important update is likely to reoccur as the server becomes more stressed with a larger work load (such as turning on local "debug" or other options, serving a massively large entity scenario, etc.)[15] This situation is not unique to the server, but it is an artifact of the distributed environment and federation design. The root problem lies in the fact that entity updates are sent unreliably (as a necessity to the overall federation efficiency). The server has been modified to specifically (and reliably) request a full attribute update every time an entity rejoins the federation (PTRs 14, 21). However, it cannot force (or know whether) the controlling federate shall provide that update. Even if that update is indeed sent, there is no guarantee that the server will receive the best effort communiqué especially as the server reaches its computation limits (as every system eventually will), nor is there a guarantee the server will receive it "in time." The very best the server can do in this environment (or any distributed

---

[15]The possibility of missing an *important* entity state update (such as the very first update) is a condition common to all simulations in a distributed environment where updates must necessarily be sent "best effort". This is one of the reasons, that it is important to stress test all components (such as the server) to have a good understanding of there ability to support a given scenario.

application can achieve when they can only **request** another federate to produce an update) is to have the ability to identify when a critical component is missing from an entity's state record.

A general purpose (federation neutral) software solution:

At the moment of discovery, (as already implemented) the server could issue the single request for the incomplete entity to publish the missing attributes. In addition to this, this same request can be repeated at the discretion of the operator and incorporated into a procedure that is executed at a scenario start or other times when a gateway is recycled[16]. To assist the operator, the server would scan through the discovered entities and determine whether any of them were missing and attributes deemed "critical" to a proper vulnerability assessment. Adding such a software module to "inventory critical attributes" on all entities and exercising it during key scenario points is the best a subscribing federate can achieve in a best-effort update environment. An open PTR has been added (PTR # 30) to note this as the most reliable (and federation neutral) feature to have. (It can also serve as a useful federation-wide tool allowing the operator to serve notice to other federates who might otherwise be sending incomplete updates). Other applications already have similar features. For example the MaK gateway will annotate entities as being "inc" (or incomplete) if they are missing certain expected fields or are otherwise incomplete. In the server's case it would be checking for lethality-specific attributes. This PTR remains open (and not implemented), since the server has technically met the bare minimal requirements in that it repeatedly demonstrated its ability to receive all critical updates and service all MunitionDetonations (even with all debugging features turned on). However the approached identified in PTR 30 will add greater reliability.

---

[16]This lesson learned has been incorporated into the runtime checklist procedures (see figure 5 6a. Run-Time Checks: gateway or other federate restart [recycle]).

Appendix I. Example of Unrecognized Target or Threat (required code modification)

In most cases, when the server did not recognize a target type the solutions was to update a simple data configuration file (explicitly identifying that target for the server)[17]. However, in one example this was not enough since the problem lay deeper (specifically with the server's software). This appendix outlines the diagnostics and resolution in such a case were the symptoms involved a vulnerability outcome that could not be determined due to an unrecognized target.

By examining the server's standard output, it was noted when the server didn't recognize a target or a munition it would justifiably report this problem by issuing a normal vulnerability/lethality (VL) result that indicated the status of the table lookup attempt such as:

VL_RSLT_ERR_NO_TABLE
VL_RSLT_... etc.

However, there was a problem observed in the server's error reporting. For the same target, threat, and firer types, at times the server reported not recognizing the target (as highlighted in the example output of figure I-1).

```
Error was code (        4): VL_RSLT_ERR_UNKNOWN_TARGET

Probability distribution: <none>
-----------------------------------------------------------------------
#--------------------V/L-Parameters--------START------
#
#------------dbEntity Coordinate System:  EQS
#------------World Coordinate System :  WQS
#
#  PARAMTER          VALUE
VLP_ang_aspect    6.115278  (350.379608 degrees)     EQS
VLP_ang_attack    0.002300  (0.131770 degrees)     EQS
VLP_impact: -0.043465 -0.261724 -1.748757 x y z (meters):          EQS
VLP_tvel:   -292.482697 49.471294 -53.837307 x y z (m/s)            WQS
VLP_range         2396.261719  (meters)      WQS  (if 0, then unknown)
VLP_target_id = 300 8 1240  (site, application, entity id)
VLP_target_type = (1,1,222,1,2,2,0)     (" T-72   MBT T-72M", )
VLP_threat_type = (2,2,225,1,1,0,0)     (" BGM-71 TOW",, )
VLP_firer_type = (1,1,225,2,1,6,0)     (" FMC M2/M3 Bradley",)
VLP_result = 1    (Entity Impact)
VLP_DetEventID = ( 0 0 6 )
#--------------------V/L-Parameters--------END--------
```

Figure I-1. Misreported target type error – yet target is clearly known (as a T-72).

---

[17]Entity names are identified in the configuration file named by the "DIS_ENTITIES_FILE" tag. The tag (and the "DIS_AUXILIARY_ENTITIES_FILE" tag) are located in the server database initialization file: "$VLS_HOME/Data/Init/vls_db_init.ini". See the manual pages (vls_db_init.ini(5)) in Sauerborn volume II (*9*).

In figure I-1 notice that the server's table lookup operation returned the result "VL_RSLT_ERR_UNKNOWN_TARGET", and yet the target *is* clearly identified by the "VLP_target_type" tag. Yet at other times, (for the very same threat-target pairing) it reported just not having vulnerability data for the same threat-target pairing (as highlighted in the example output of figure I-2).

```
 Error was code (        1): VL RSLT ERR NO TABLE

Probability distribution: <none>
------------------------------------------------------------------
--
#-------------------V/L-Parameters--------START------
#
#------------dbEntity Coordinate System:  EQS
#------------World Coordinate System :  WQS
#
#  PARAMTER          VALUE
VLP_ang_aspect    0.297248  (17.031069 degrees)     EQS
VLP_ang_attack    0.001601  (0.091712 degrees)      EQS
VLP_impact: -0.426856 1.387467 -0.219724 x y z (meters):
EQS
VLP_tvel:   -292.982178 59.249527 -39.280312 x y z (m/s)
WQS
VLP_range         2429.578857   (meters)        WQS  (if 0, then
unknown)
VLP_target_id = 300 8 1237  (site, application, entity id)
VLP_target_type = (1,1,222,1,2,2,0)    (" T-72  MBT T-72M", )
VLP_threat_type = (2,2,225,1,1,0,0)    (" BGM-71 TOW",, )
VLP_firer_type = (1,1,225,2,1,6,0)     (" FMC M2/M3 Bradley",)
VLP_result = 1    (Entity Impact)
VLP_DetEventID = ( 0 0 22 )
#-------------------V/L-Parameters--------END--------
```

Figure I-2. Reported unknown data table (for same threat-target as figure G-1).

Since both these differing responses where generated from the same target, threat pairing the software that processes these pairings falls suspect. The function call that generates the server's result code (i.e.: "VL_RSLT_ERR_UNKNOWN_TARGET") relies on a non-reentrant function: vl_GetResultErrorValue() this function returns the most recently generated error created during the table lookup process. The set of return codes are displayed in table I-1.

However the : vl_GetResultErrorValue() function relies on a general purpose non-reentrant error reporting library function: rpt_error_getErrno(). This error reporting library is a general purpose library but has the following application specific return values tailored for the server:

Table I-1. Vulnerability lookup call result codes.

V/L Return Code	Meaning
VL_RSLT_ERR_GENERAL	Unknown error
VL_RSLT_SUCCESS	Success - NO error. The server was able to identify the target, threat, and enough initial condition parameters to able to execute a v/l assessment (usually table lookup). In addition, it was able to find, retrieve, and execute a table lookup on the v/d data source and return a valid result.
VL_RSLT_ERR_NO_TABLE	No Table – the server could not find a v/l data source (lookup table) to address the threat-target combination.
VL_RSLT_ERR_CURRUPT_TABLE	Corrupt Table – the found a v/l table, but it was corrupt (incorrectly formatted) or else perhaps it is a miss-labeled format.
VL_RSLT_ERR_NO_ENVIRON_DATA	No Environment Data – the server could not identify one or more of the critical initial conditions (parameters) required in the v/l assessment.
VL_RSLT_ERR_UNKNOWN_TARGET	Unknown Target – the server didn't recognize the target type.
VL_RSLT_ERR_UNKNOWN_THREAT	Unknown Threat – the threat was unrecognized.

Table I-2. "Return-Error" (RE) codes returned by `rpt_error_getErrno()`.

Report Error Return Code	Meaning
RE_DBERR	General Master Data Base Error
RE_DBFLDERR	Invalid field in database element
RE_DBBADKEY	Invalid or dangling key pointer
RE_TGT_UKNOWN	Invalid or undefined target entity
RE_THREAT_UKNOWN	Invalid or undefined threat entity type
RE_DET_EVENT_UKNOWN	Invalid or undefined detonation event
RE_NO_META_REC	V/L Data meta record not found.
RE_VLSOURCE_INTERP	Error interpreting V/L source data.
RE_NO_ENVIRON_DATA	Could not find or set V/L environment (initial) parameters for this case.
RE_NOSHM	Shared memory not attached.

These error values are set by any function invoking the server library call `_rpt_error()`.

It is therefore possible that an intermediate function is generating (and setting the error value).
However, this possibility was discarded after noting how the server processes detonation events.
Detonations are received and stored in a queue for processing. When the processed, queued
detonations are serviced in the order they arrived until the queue is exhausted (first in first out).
It would therefore be impossible for one detonation to set the error report and have that report
associated with a different detonation (unless the queuing system was broken). It would also be
an error if the servicing function returns before emptying a completed detonation thus leaving it
in the queue to be (inadvertently) reprocessed. The source code was examined for all three
possible errors: 1) an intermediate function calling `_rpt_error()`, 2) a broken queing system,
and 3) a premature return prior to the completely processing a detonation. The results of the

investigation explained why the server was responding (by apparently not recognizing known targets).

Within the server's application programming interface (API), a function `vlp_setp_all_Munition_Frm_DIS()` sets data dictionary variables with initial condition values based on the synthetic environment (in this case DIS PDU data structures as translated from the HLA data).   This function requires a detonation, shooter (firer), and target PDU data structure. If any one of these were absent, the API declared an error and returned. As shown in lines 100 – 101 of the `vlp_setp_all_Munition_Frm_DIS()` function:

```
100      if ( firer == NULL || tgt == NULL || det == NULL ) {
101         ++error;
```

Thus, when the firer could not be determined, the initial variables were never set. This resulted in the server misreporting initial conditions variables (that were assigned during a previous detonation when all required input *were* available). This is one explanation why "known targets" were being misreported as "unknown targets." It was thought to be unknown because the last set of initial conditions may have displayed an unknown target type from a previous and unrelated detonation).

These errors were addressed and corrected in the changes made in PTRs 10, 11, and 15a.

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3   DIR US ARMY TRAC
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           C DENNY D DURDA
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3   CDR TARDEC
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PICATINNY ARSENAL NJ 07806-5000

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10401 TOTTEN ROAD
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FT BELVOIR VA 22060-5823

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KANSAS STREET
NATICK MA 01760-5020

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BLDG 91012
FT HOOD TX 76544-5068

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1   CDR US ARMY ELECTRONIC
     PROVING GROUND
ATTN CSTE DTC WS EP TT L R LEIBERT
FORT LEWIS WA 98433-9500

1   CDR US ARMY REDSTONE TECH TEST CTR
ATTN T CLARDY
BLDG 4500
REDSTONE ARSENAL AL 35898-8052

ABERDEEN PROVING GROUND

1   DIRECTOR
US ARMY RSCH LABORATORY
ATTN AMSRD ARL CI OK (TECH LIB)
BLDG 4600

1   DIR AMSAA
ATTN D JOHNSON
BLDG 248

2   DIR AMSAA
ATTN B BRADLEY A WONG
BLDG 367

3   DIR AMSAA
ATTN D HODGE B KELLY
        K STEINER
BLDG 392

4   US ARMY DTC
ATTN CSTE DTC TT M M LORENZO
        R COZBY D BENCH J CHEW
RYAN BLDG

2   DIR USAEC
ATTN CSTE AEC MS W JONES
        R MIRABELLE
BLDG 4120

  1   CDR US ARMY ATC
       ATTN CSTE DTC AT FF H CUNNINGHAM
             CSTE DTC AT FF T P TENNANT
               J CORDE LANE
             CSTE DTC AT FF V A DOCIMO
               J FALLER   G HINKLE
               S TAKAMOTO
       BLDG 400

  5   US ARMY RESEARCH LABORATORY
       ATTN AMSRD ARL WM BF
             S WILKERSON G SAUERBORN (4)
       BLDG 390

  4   US ARMY RESEARCH LABORATORY
       ATTN   AMSRD ARL SL BE L BUTLER
             R BOWERS   T CHRISTY
             E GREENWALD
       BLDG 238

  3   US ARMY RESEARCH LABORATORY
       ATTN AMSRD ARL SL B R SANDMEYER
             P TANENBAUM   B WARD
       BLDG 328

  1   US ARMY RESEARCH LABORATORY
       ATTN AMSRD ARL SL BE   L ROACH
       BLDG 328

  1   US ARMY RESEARCH LABORATORY
       ATTN AMSRD ARL SL BN W WINNER
       BLDG 328

  1   DIR USARL
       AMSRD ARL WM W J SMITH
       BLDG 4600

  1   DIR USARL
       AMSRD ARL WM B T KOGLER
       BLDG 4600